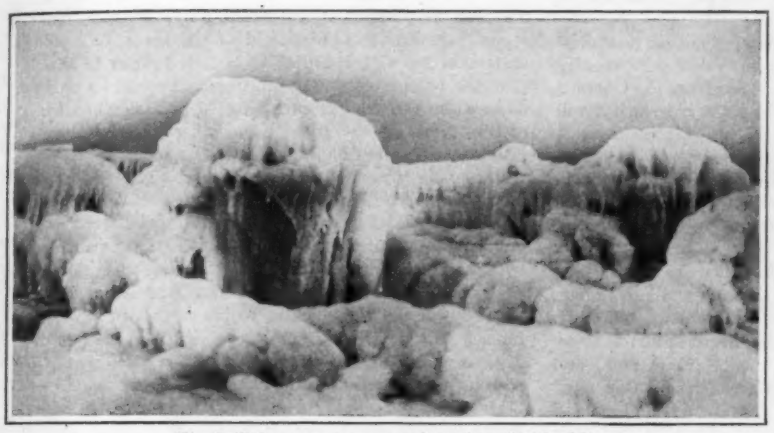
SEVENTY-FOURTH YEAR

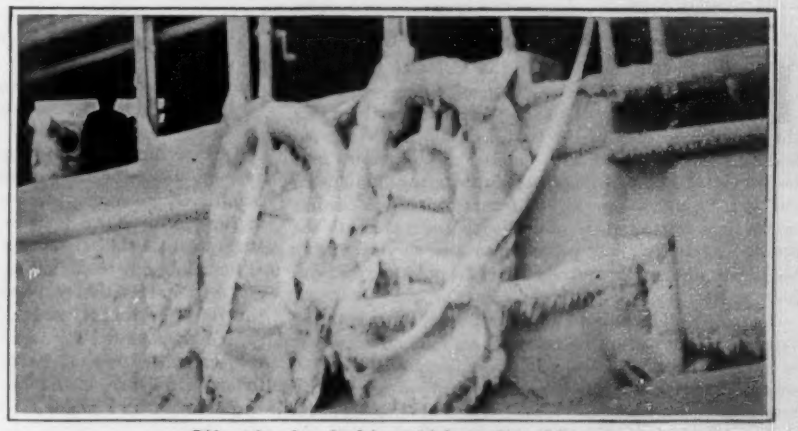
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

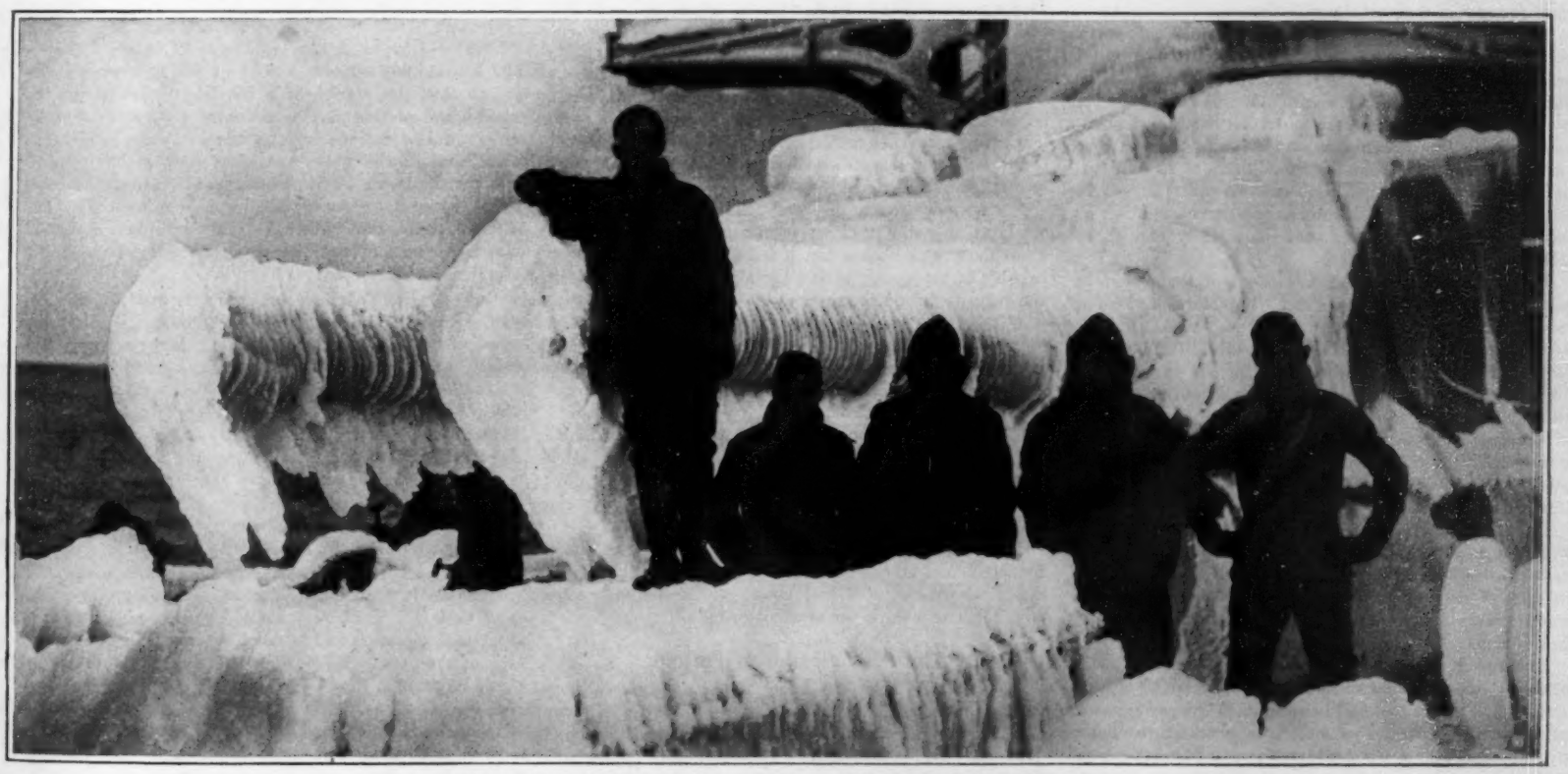
VOLUME CXVIII. NUMBER 19] NEW YORK, MAY 11, 1918 [10 CENTS A COPY $4.00 A YEAR



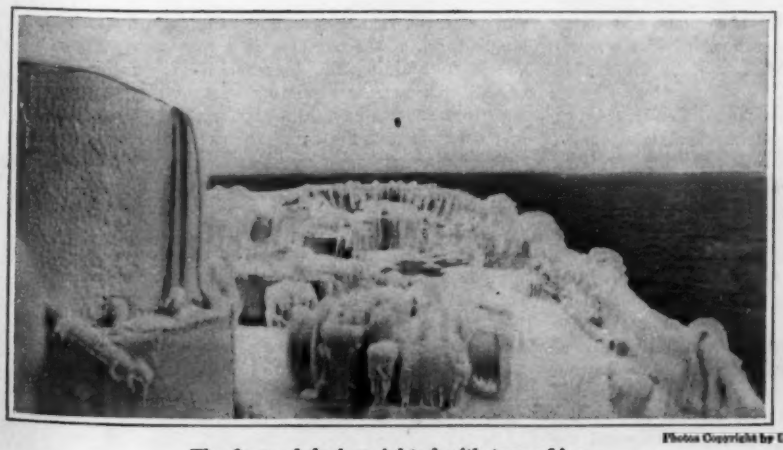
North Pole scenery on an American battleship



Life rafts sheathed in a thick coating of ice



The turret and big guns of one of our warships clothed in icy drapery



The forward deck weighted with tons of ice

Clearing the frozen spray from the battleship's deck

Photos Copyright by Underwood & Underwood

SCENES ABOARD AN AMERICAN WARSHIP AFTER PLOWING THROUGH A ROUGH WINTER SEA

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, May 11, 1918

Charles Allen Munn, President. Frederick C. Beach, Secretary. Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Copyright 1918 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Today—and Other Days

IN the Revolutionary War the Colonial forces aggregated 309,761 men. This, of course, does not mean that at any one time there was anything like that number of men in the field, but simply that, from first to last, there were that number of men sworn into the service. Many of these were in the army throughout the war; many others served for periods of but a few weeks or a few months. But the figure represents the number of individuals passed into the service during the period of the war, and as such is the only one that can have value.

The population of the United States, according to the census of 1790, was in round numbers four millions. It is hard to believe that the increase from 1783 to 1790 was more than enough to offset the loss, by death and by emigration to Canada, the West Indies and Great Britain, during the period 1775-1783. On this basis, then, we find that the Colonies put into their armies approximately eight per cent of their total population.

This performance was duplicated in 1812. From a population of 7,200,000 there was recruited a total armed force of 605,046; the percentage is a trifle larger, but still, in round numbers, eight. Our efforts in the last war, that with Mexico, were as trivial as those in connection with the disturbance of 1898. In the one case we found 101,282 soldiers in a population of 23 millions; in the other, 223,235 men enlisted out of a total of 76 million souls. In both instances the percentage is well below one-half of one per cent—not really enough to talk about.

The truly prodigious military effort of the American people was that of the Civil War. The Northern States, from a population of 22,000,000, secured 2,859,132 men for the service; the South found about 1,100,000 of its eleven million residents who could be put under arms. On the one side thirteen per cent of the entire population was put into the war; on the other, ten per cent; in the entire nation, in round numbers, one person in every eight. Until the present debacle of nations, this performance was unique—a source of constant wonder in all quarters.

One year ago the strength of the American army was 212,034; today it is 1,652,725. Our population is conceded to be 100 millions for purposes of discussion. So in spite of the heavy increase which we have scored for our armies, we have put but 1.6 per cent of our numbers in uniform.

Yet we talk of supreme efforts in terms of a "gigantic" army of five million men! May we not well pause to realize that before we shall have equaled the performance of the thirteen Colonies we shall have increased this figure by half, that before we shall have put ourselves on a par with the beaten Confederacy we shall have doubled it? May we not give thought to the fact that in order to put forth an effort duplicating that of the North, we must raise an army of thirteen and one-half million men?

It is absurd to look with complacence upon the insignificant military aid which the average American has in his mind when he contemplates our share in the great war. There are plenty of people now living who fought in the Civil War; plenty more who lived through it. If we would but remind ourselves that before we shall have equaled the achievement of their generation, we must still put 11,500,000 troops in the field, perhaps we should look with less complacence upon what we have done, and with less misgivings upon the raising of the next million, or the millions after that.

The Lesson for America of the German Offensive

THREE times during the past six months Germany has proved that a modern entrenched line can be broken. She proved it at the Isonzo, on the Somme, and in Flanders. Also she has proved that, in order to secure an absolutely decisive result, not only must the line be broken, but the breech must be maintained. If the enemy's line is to be burst apart and rolled up on its broken flanks, and the organization of his armies is to be destroyed by ceaseless onslaught, resulting in captures and dispersion, the attacking force must maintain its original strength and its original mobility until a decision has been reached. Germany has thrice succeeded in the first half of the program, and thrice she has failed in the second. She has failed because she lacked both the numbers and the swift mobility which are the absolute prerequisites for success.

The indications are that the present German attempt will prove to be abortive. If so, Hindenburg will have to dig in where he stands. Or, if General Foch should launch a great offensive when the German rush has spent itself, it is conceivable that the enemy may be thrown back upon the Hindenburg line, and hold there for the winter months.

If so, what then? What of the campaign of 1919? What is to be America's part in that campaign?

It is with the fullest appreciation of the unbroken strength and dauntless spirit of our Allies, that we say that the issues of 1919 will be determined by the size and character of the forces which we have on French soil by the summer of next year.

The German line can be broken—there is no doubt about that. Furthermore, it can be broken permanently and to such a depth, that the whole line from the Channel to the Alps, in self defence and for its very security, will be obliged to fall back.

This can be done, but it can to be done only if America at once, *today*, begins to mobilize its whole strength in manpower, machinery and munitionment, with a view to having 3,000,000 men in France by the summer of 1919, with 1,500,000 available as a mobile army of attack.

Remembering that mass and mobility are the *sine qua non* for an army that can break through and keep going, this force, both in its training and equipment, should be supremely adapted for rapid and irresistible follow-up movement. It should be an army of marksmen, and its main reliance should be upon the rifle. Our most excellent Browning gun, both the shoulder piece and the machine gun, should be supplied up to the limit at which the bringing up of ammunition would act as a drag upon mobility. Also, with an eye to mobility, the field artillery should be restricted to the French 75; and if any 4's or 4.7's are included, they should be motor-mounted. Indeed, it is a question whether for a break-through and follow-up army such as this, it would not be advisable to have the whole of the artillery motor-mounted or at least motor-hauled. A burst of shrapnel that would put an artillery team out of action, might fail to disable a motor truck.

Furthermore, such an army should depend exclusively upon motor truck service for its supply train. Our great motor-truck industry, if fully mobilized, should be capable of supplying, within the next twelve months, all the transportation required.

With an army of 1,500,000 men so equipped, composed of troops intensively trained in marksmanship; supplied with a vast number of our light Browning machine guns and automatics, and a proportionate force of motor-mounted, or at least motor-hauled field guns, we believe the German line could be broken, the breech maintained. The attacking army would be capable of such rapid movement, that the retreating Germans would never have time to dig in, as they did after Foch broke the line at the Battle of the Marne.

If it were deemed advisable that this army of shock attack should be composed of mixed French, British and American troops, well and good; but it should possess to a supreme degree the element of mobility.

The Mathematics of Farming

ANYONE who has been thinking of taking up farming in a gentlemanly sort of way, as a haven of refuge from the cares that oppress the Tired Business Man, would do well to pause before he commits himself finally to the undertaking. Such a person should take stock of his educational standing; and if he finds that he is not well up in all the higher branches of mathematics—well, he may be a brilliant success in some less exacting calling, but as a farmer he were hopeless indeed, and he should reverently stand aside to give place to his better.

To the lay mind it might seem that the cultivation of the soil does not require any vast mathematical equipment. Even one several steps removed from the laity might be excused for imagining that if the farmer can add and subtract and multiply and divide and draw a straight line, he has got about as far along in the science of number as he need go. Only a little while age, we ourselves might actually have thrown the weight of our editorial opinion upon the side of this heterodox viewpoint. But the other day we found in our mail a 40-page pamphlet by Prof. E. A. White of the University of Illinois, bearing the title, "A Study of the Plow Bottom and Its Action upon the Furrow"; and we now realize what a harmful and superficial attitude we, in common with most of the human race, have taken toward the noble intellectual pursuit of making two blades grow where one or none grew before.

We suppose that any rational creature would be prepared to concede that it makes a difference what the shape of the plow bottom is. Conceivably it might even occur to the man in the street that there is a field for a certain amount of scientific investigation in the determination of the best shape. But this is only a beginning. One comes away from Professor White's pages with a vivid sense of the crime against civilization and humanity which is committed when one not versed in the geometry of cycloids and catenaries, helices and conicoids and generators attempts to put his hand to the plow. It is now obvious that before a man can hope successfully to prepare the ground for the sowing, he must appreciate the classification of plowshares into "(1) single quadric surfaces, (2) combinations of parts of two quadric surfaces, and (3) non-quadric surfaces."

At present we regret that our farming population does not measure up to this high standard. With the inspiration of Professor White's monograph before him, however, may we not look confidently forward toward the day when the farmer boy will be a hopeless anachronism if he cannot state offhand whether his plow is a "hyperbolic paraboloid, a helicoid, a hyperbolic cylinder, a conic frustum, a hyperboloid of one sheet, or a ruled surface of the eighth order?" Is it too much to anticipate the coming of the agriculturist who will be able to deduce the equation of such a ruled surface when three of its generators are given, who will rejoice in a translation and rotation of the coördinate axes in space, who will take his direction cosines to bed with him each night, and who will gladly leave his breakfast, and even neglect his family to play with the good professor's cubic equation in three variables and six parameters, with a determinant of third order as its constant term?

In that happy day, the ignoramus who is not able or willing to apply the calculus to his crops will have only himself to blame for the failure which is certain to dog his every effort. But the farmer who is properly equipped for his exacting calling, on the other hand, will derive a vast amount of inspiration from such helpful works as the one of which we speak. What greater delight can be imagined, what more effective recreation after a hard day's work in the field, than to deduce the properties of the plow whose surface has the equation "$0.54x^2 - 1.52y^2 + 1.12z^2 - 3.69yz - 1.62xz + 2.04xy + 53.63x + 114.90y - 46.40z + 49.40 = 0$"? And when it develops that the motion of a particle of soil across the mold-board of this plow is governed by a system of six differential equations of the second order which, as mobilized on the page, measures four inches by two and three quarters, what farmer could contemplate this result without an irresistible impulse to rush right out into the pasture lot and make every soil-particle therein march across his mold-board in accordance with the dictates of these equations?

But enough. We have touched first upon the humorous aspects of Professor White's monograph solely because, after we had read his very innocent title and opened at random to an especially awe-inspiring page of derivatives and integrals and equations in x, y and z, this was the first aspect which came to our mind. Of course our humor, like most humor, is based upon a false assumption—in this case, we are happy to confess a consciously false one. For the worthy professor's work is intended, not for the farmer who uses the plow, but for the manufacturer who makes it and for the designer who instructs him how to make it.

Every person of engineering instinct will realize that a plowshare is a geometric surface, having an equation, and that it is eminently sound engineering practice to find that equation and to use it in discussing the properties of the plow. Were this not the case, we should not have mentioned the undertaking on this page—not even for the purpose of having a little harmless fun at the expense of its sponsor. And before leaving the matter, we want to point out its true significance to the man who is inclined to laugh at it and dismiss it in the spirit in which we have introduced it.

Sound engineering practice is today getting to be more and more the rule, less and less the exception. We no longer think of the engineer as a man who confines his efforts to building the biggest bridge, or the newest engine, or the greatest building, or something else equally spectacular. We have him with us all the time, in more and ever more of the small things of life. He invades every hallowed sanctuary of guesswork and the rule of thumb, showing us how to do better the little things as well as the big things, laying down scientific principles to guide our every trivial undertaking. He is just as much at home in dictating the proper shape of our plowshares or in showing us the best arrangement of the page in our telephone directory as he is in telling us how big a cable we need to hold up the Brooklyn Bridge or in finding a way to drive a tunnel through the mud beneath the East River bottom. He goes about making mountains of our molehills, and then finding a passage through or around the mountain which shall be smoother than the old one over the molehill. And the world is the better for his willingness to devote his energy to commonplace things and put them on a sound engineering basis.

Electricity

New French High Power Radio Station.—It is announced that the French naval authorities have recently erected what is claimed to be the most powerful wireless station in the world, and which is capable of sending messages as far as Australia. If this proves to be true, the station has a range of at least 15,000 miles.

Electric Signs for Vaudeville Numbers.—A recent application of electricity is that of electrically-operated cards or announcements for vaudeville performances. In Worcester, Mass., a theater has recently provided two of these electrically-operated cards. Each consists of ten ground glass slides placed one above the other and arranged to be separately and individually illuminated by lamps back of them. Thus it is possible for the stage manager to flash any "card" desired by merely turning a switch, and whether the theater is illuminated or not the sign shows plainly. Much time is saved, and, what is perhaps of greatest importance in these times of labor shortage, no card handler is required.

Injury to Connecting Cords is quite frequent with such electrical devices as irons, toasters, percolators, and so on, because of the practice of making and breaking the circuit with the plug. Each time the plug is pulled away from the contacts, an arc results, and it is evident that the great heat of this arc must in time burn the insulation and melt or make brittle the copper wire. At some future time the connecting cord generally gives out, causing much inconvenience. To obviate this trouble an electrical manufacturer has now come forward with a switch which is designed to be inserted in the connecting cord, thus taking away from the plug the duty of making and breaking the circuit. Equipped with large contacts and designed for a quick break, the switch handles the current without injury to the cord; also, it is more convenient than the usual method.

Measurement of Light for Biological Purposes.—Dr. D. T. MacDougal, director of the Carnegie Department of Botanical Research, states in a recent report that while the blue-violet region of the spectrum is of the greatest interest to the biologist, the intensity of radiation in this region cannot be measured satisfactorily with photometers, thermopiles or pyrheliometers. Accordingly he plans to use in his work the photoelectric cell, as developed by Elster and Geitel and by Dr. Jacob Kunz. This instrument has the great advantages of extreme sensitiveness in the blue-violet region and ease of manipulation. It records immediate and directly proportional values, and can be used for wide ranges of intensities. It seems likely that more exact measurements in the blue-violet region, which is so important in photolysis and phototropism, will clear up some obscure question connected with these phenomena. The action of the photo-electric cell in light is said to be more nearly parallel to that of the organism than that of any other light-measuring instrument now in use.

Electrical Treatment of Seeds.—The English press is manifesting considerable interest at present in the question of the application of electricity to agriculture as a means of increasing the supply of home grown foodstuffs. Experiments which have been going on for some years in England have clearly demonstrated that the use of an electric discharge has a marked effect on crop production. The subject has lately been brought to the fore by Charles Mercier, who, writing to the *London Times*, states that "great and startling improvements in agriculture are on the point of being introduced," and says that a method has been devised to overcome the difficulty of expense of electrification, as applied to both the growing crops and the seed before it is sown. Installations at which farmers can have their seeds treated by experts have been erected at several centers, and are capable of treating some 30,000 sacks per month. The increase of yield from seed so treated, though not so great as the increase from electrification of the growing crops, is stated to be considerable, ranging from 25 per cent to as much as 80 per cent.

Dry Cell Testing Precautions.—Very small diameter wires should not be used for the ammeter leads in testing dry cells, warns Fred W. Cline, writing recently in the *Electrical Review*. These conductors should not be more than 12 inches long and of a cross-sectional area equivalent to at least that of No. 12 B. & S. gage wire. The ammeter leads should not be held on the binding posts of the cell under test for more than two or three seconds to prevent needless waste of the cell. An ammeter connected directly across the terminals constitutes an almost "dead short circuit" and will, therefore, quickly "exhaust" and spoil the cell. Always hold the ammeter lead terminals on the brass binding posts of the cell; it is not good practice to hold the end of one ammeter lead on the upper end of the carbon cylinder and the other on the edge of the zinc casing because of the uncertain contact thus obtained. Finally, be certain that the ammeter or battery tester which you are using is correct. The value of your test depends wholly on the accuracy of the testing instrument. Hence, the ammeter should be compared often with a standard instrument which is known to be absolutely accurate.

Astronomy

Dr. Otto Klotz, recently appointed director of the Dominion Observatory at Ottawa, has presented to the observatory his technical library of more than two thousand volumes.

La Revue du Ciel.—This little journal, devoted to popular astronomy and kindred subjects, is now entering its third year. It is published at the observatory of Bourges, France, by the Abbé Moreux, and is an interesting addition to the list of publications addressed frankly and exclusively to the amateur observer.

The Astrophysical Journal calls attention to a very unusual circumstance—the bombardment of an astronomical observatory. The observatory in question was that at Poulkoro, near Petrograd, and the artillery fire to which it was exposed for four hours on the afternoon of November 12th, was an incident in a prolonged encounter between Cossacks and Bolsheviki.

A New Unit of Stellar Distance is suggested by M. de Rey Pailhade in a letter to *L'Astronomie*. The writer is president of a committee for the propagation of the decimal system, and the unit he proposes would conform to that system. Its value is 10,000,000,000 kilometers, and he proposes to designate it by the name or symbol *Us* (unité stellaire). A light-year is equivalent to 946 Us, and a parsec to 3,078 Us. The distance of 61 Cygni is 5865 Us; the mean distance of the earth from the sun, 0.015 Us.

Webb's "Celestial Objects."—The innumerable amateur astronomers who were brought up on "Webb's Celestial Objects for Common Telescopes" will welcome the recent appearance of a new edition (the sixth) of this classic. Four editions of the work appeared during Webb's lifetime. A fifth, edited and much enlarged by Rev. T. E. Espin with the coöperation of several specialists, was brought out in 1893, in two volumes. The new edition is also edited by Espin, who has rewritten the second volume, which now embraces more than 3,000 telescopic objects, while several well-known astronomers have contributed to the work. There is a new map of Mars by Antoniadi and one of the moon by Goodacre.

The Sunspot Period.—An interesting discussion of the 11-year sunspot period, by J. Larmor and N. Yamaga, appears in the Proceedings of the Royal Society. The writers have reëxamined the available data for 160 years from 1750 to 1910, and find an unbroken solar periodicity of about 11.125 years, if the two strongly discrepant cycles from 1776 to 1798 are left out of consideration. Mathematical analysis shows no other periods that are not of a sporadic character. A letter from Wolfer, the well known compiler of current sunspot numbers, gives some facts as to the history of the data. Those for the discrepant period were almost all made by Stoudacher, of Nuremberg. The epochs of maxima 1778 and 1787 are believed to be fairly reliable and it is concluded that the anomalous lengths of the periods between 1770 and 1805 are real.

Proxima Centauri.—We have previously announced the discovery by Mr. Innes, of the Union Observatory, Johannesburg, of a faint star in Centaurus having about the same parallax as Alpha Centauri, which has long enjoyed the reputation of being the nearest known fixed star. Observations for determining its parallax more accurately have been made at the Union Observatory during a period of more than a year, with a micrometer attached to the nine-inch equatorial, and the resulting value announced by Mr. Innes is 0.88 sec., as compared with 0.759 seconds, the latest value given for the parallax of Alpha. Thus it appears that the Innes star is the nearest known star in the heavens, and its discoverer has suggested for it the appropriate name of Proxima Centauri. Its visual and photographic magnitudes are 11 and 13 respectively.

Our Motion in Space.—Figures on this subject are necessarily relative, as there is no such thing as absolute location in space, or, if there is, we have no means of determining it. The motion of our planet with reference to the sun is known quite accurately. The general drift of the solar system as a whole has been measured with respect to the brighter stars. Thus, from the radial velocities of 1,193 stars, as measured with the spectroscope, Campbell found that our solar system is moving through space at a speed of 12 miles a second. Now comes the "island universe" hypothesis, according to which our stellar system and the Milky Way are a great spiral nebula which we see from within, while the spiral nebulae which we see as such are other stellar systems, far remote from ours. How fast are we moving with respect to these remote bodies? According to Dr. Slipher, who admits the meagerness of the data available, the average radial velocities of the spiral nebulae indicate that the solar system and the vast stellar system to which it belongs are moving, with respect to the average positions of the spirals, at a speed of about 435 miles a second, toward a point about R. A. 22 hours and S. Decl. 22 degrees.

Industrial Efficiency

Reducing Waste in Telephone Installation Work.—A leading telephone company has as part of its war-time program, brought to the attention of the installers the importance of eliminating waste of material. In this connection it has prepared a striking display of the various materials used, with the price of each; thus, small tacks are shown at 70 cents per 1,000, toggle bolts at 3 cents each, wire at 1¼ cents per foot, insulating tape at 18 cents per roll, angle pieces at 7 cents each, porcelain insulators at 1¼ cents each, and so on. This graphic lesson on the cost of material serves to encourage men to save in these times of economy.

How the Germans Get Trade.—According to the *Continental Press*, the Germans have taken advantage of the war to develop the Polish market for their goods. Two years ago several chambers of commerce in east Germany, together with the Berlin chamber, combined to establish a joint bureau in Poland. This bureau now represents 84 trade bodies and has opened show rooms in Warsaw, Lodz, Kalisz, Chenstochow, Sosnowice and elsewhere. It negotiates the purchase and sale of articles not subject to government control, and finds suitable agents for firms when desired. It further aids in the introduction of German wares through exhibitions, both general and special, in which particular attention is given to the needs and tastes of the Polish people.

Motion Pictures to Get Trade.—The Motion Picture Exhibition of British Industries is organizing a tour of the important cities of western Europe, North and South America, and the British dominions. Films will be shown illustrating the manufacture and use of British-made goods. The exhibitions will be given under the auspices of British chambers of commerce in allied countries and the self-governing dominions. In 85 of the principal cities of the world films are to be exhibited illustrating leading British industries and manufactures, and to these exhibitions representatives of the principal firms in the cities visited will be invited. A British manufacturer may have films of his industry prepared by the company, and these will be exhibited in such places included in the tour as he may select.

A Fortune in Flying Chips.—The machining of metal parts of any description can not be done without a certain loss of metal by the chips flying off during the work. This loss, in the case of high priced metals, adds considerably to the price of the article made from the material in question. To reduce the loss, a good many methods have been suggested by most of which it is tried to collect the flying chips so that they can be remelted. Even this, however, very often is only possible under great difficulties and it is estimated that millions of dollars yearly are lost to the nation from this source alone. For instance, the aluminum chips coming off while machining aluminum castings for automobile gear boxes, total in value more than $3,000,000 annually. In former times, nearly 50 per cent of these aluminum chips were simply thrown away. Now it has become possible to recover a large percentage of the metal by remelting and the actual loss has been reduced to approximately 20 per cent and there are firms who confess to recover even more of the metal. By doing so, approximately $2,500,000 have been added to the yearly income of the United States. Here is a chance for machine shop managers to increase the earnings of their plants by making use of what formerly was thrown away.

The High Cost of Railroads.—Railroad equipment has gone up in cost during the last three years and the life of the equipment buyer of a large railroad is not an easy one. In former years he could buy quite a serviceable box car for $1,200 now he has to pay at least $2,600, and even considerably more is charged. Passenger cars are costing $5,000 and more, according to interior decoration and general construction, and locomotives which in former years could be bought for about $30,000 now are charged for at the rate of $60,000. Steel rails, which were exported three years ago at an average of $31 a ton, are now shipped at $46. No wonder, therefore, that the railroads have not been over enthusiastic in their purchases. There were less locomotives bought by American railroads during the last four years than for many years and the purchases of freight cars also have fallen to less than half of their former number. Railroads, by the way, only rarely buy their rolling stock on the "cash and carry" system. Most railroad purchasing, in fact, is done on the "easy payment" plan. The business is transacted in very much the same way as is done in the case of a citizen of limited means purchasing his furniture. The railroad, in ordering its new equipment, makes an arrangement with the company supplying the goods as to how payments will be made. As a rule notes are given, the interest and principal of which are payable in instalments. The selling company remains the owner of the equipment sold until the whole of the indebtedness is paid off by the railroad. In this way it is possible for a railroad to keep up its general equipment without laying out too much money in one lump sum. It is, in fact, a case of "furnish out of your income."

Hogs and the War

Increasing Our Pork-Raising Facilities to Produce Wartime Meat

PORK, more pork, and still more pork! That is one of our battle cries at a time when we are engaged in a gigantic conflict and when the food question is unusually serious. So for the time being there are many farmers intensely interested in raising more and better hogs, and much is being learned concerning the feeding and management of the familiar porker.

There are many reasons—very good reasons—why pork is an ideal war meat. In the first place and from the standpoint of economy, it is the least expensive and most satisfactory meat to raise, pound for pound. The handling of pork, too, is quite simple and satisfactory; for in the cured condition it requires no refrigeration and can be shipped with the least trouble and in the smallest space. Its keeping properties are, of course, excellent. Finally, pork is the soldier's and the workman's meat; it meets the demands of the hard worker's appetite.

Among the many organizations engaged in a scientific study of the feeding and management of swine is the New Jersey Agricultural Experiment Station at New Brunswick, N. J., where interesting experiments and researches have been carried out under the direction of J. Marshall Hunter, animal husbandman. Coming at a time when the feeding of hogs represents a far greater expense than formerly, these experiments have a certain dollars-and-cents value to the hog raiser who must keep one eye on the price per pound that he receives from his customers, and the other on the price of hog feed.

So the feeding of hogs, as a result of many experiments and researches, is fast being reduced to a scientific proposition.

Home-grown feeds should be fed whenever possible to the swine, according to Mr. Hunter. Especially is this practice recommended in the instance of crops that benefit the soil and serve the production of economical meat through their being fed to animals, for it makes for prosperous farming. In New Jersey, corn and alfalfa may be considered the basis of an economical swine ration. They are crops which not only occupy a practical place in the grain rotation, but are capable of yielding more pounds of feed nutrients per acre than any other grain and forage crop common to that section. On the other hand, it is usually more economical to purchase a limited amount of such concentrates as tankage oil meal and middlings rather than to depend entirely upon grain and roughage grown on the farm.

Aside from corn which alone fails to supply the requirements for rapid and efficient gains, there are other feeds such as oats, rye, hominy, low grade flour, oil meal, tankage or meat meal and skim milk, but space does not permit an extended discussion of the relative merits of each. Suffice it to say that the hog raiser of today has data which enable him to decide the proper proportions of each feed for hogs of various ages, because he knows the nutritive value of each from the hog's point of view.

Hogs! Last year the number of hogs in the country was increased 3,871,000 over 1916. The hog is most assuredly "doing his bit"

Giving hogs a dip in a chemical bath in order to kill lice and other parasites

Another question that has been solved of late is whether hogs should be self-feeding or not. Judging from reports at hand it appears that self-feeders have met with favor throughout the country as a means of feeding market pigs. The free-choice system is being largely followed by hog raisers, in which several feeds are supplied in separate hoppers of the self-feeder and the pig is given free choice regarding the proportions and amounts of different feeds eaten. Such a system, of course, allows the pig to eat as often as he pleases, as contrasted to the hand-feeding method twice daily. It is claimed for the self-feeding method that the growing pig and particularly the young pig has a very limited capacity for handling feed, and therefore does not over-indulge. Consequently the pig, following the dictates of his appetite, is never hungry or never gorged with feed. Hand feeding, on the other hand, has a tendency to cause the pig to tax his stomach beyond its normal capacity, causing him to be gorged for a few hours and then forcing him to go hungry for some time before the next feed. All in all, it has been found at the New Jersey station and other stations that the self-feeding method is not wasteful of feed and produces the best results.

The feeding of garbage to hogs has been the subject of much discussion of late, particularly since the establishment of army cantonments in various parts of the country with the resulting concentration of fairly clean garbage. The same is true of the large shipyards and industrial communities, where tons of garbage are dumped near at hand before it has become mixed with deleterious materials. This garbage has a distinct feeding value for swine, and while there is comparatively little experimental evidence at present concerning the possibilities of garbage as a hog feed, the practice of raising hogs on garbage is flourishing in certain centers and has a very promising future.

Garbage, as the word is commonly used,

(Concluded on page 438)

All photographs on this page copyrighted by Underwood & Underwood

Self-feeders and houses for little pigs — Inside a model hog house, with walls and feed troughs of concrete — A prize porker with his house and feed basin

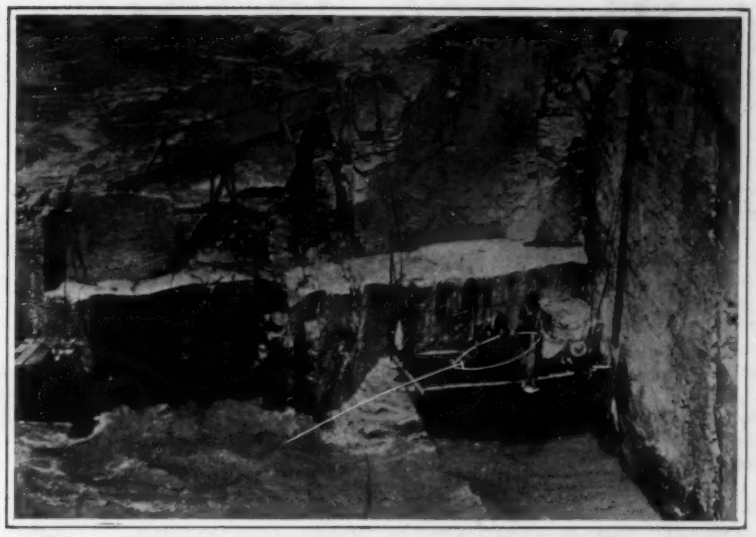
Views of the New Jersey Agricultural Experiment Station, where the hog is being scientifically studied

Helping the Salmon Over a Hurdle

IN getting to fresh water to spawn the salmon performs feats which, in spite of the frequency with which we read about them, are almost unbelievable. Low waterfalls are carried in a single leap, and the fish will actually swim up a fall ten or fifteen feet high, choosing for this stunt the place where the volume of the fall is heaviest, and going up with a rush of flying fins. But just as the result of bringing an irresistible force in play against an immovable obstacle depends upon the degree of irresistibility and immovability, so the salmon, with all his power, once in a while finds an obstruction against which he cannot make head.

Thus, in 1913, a railroad that was being constructed along the Fraser River in British Columbia had choked up the stream with a mass of blasted rock, half closing the river and making the channel very narrow and extremely swift for quite a distance. The salmon found this quite a different proposition from the mere scaling of a short waterfall, and were quite unable to go up the chute thus formed. A serious situation was threatened, since if the fish could not get up the river they would not spawn, while if they did not spawn there would be no young salmon of 1913 to come back at maturity in 1917 and perpetuate the race in their own birthplace. A year of no salmon in such an important fishing ground as the Fraser River would have been a disaster indeed.

Accordingly the Dominion Fisheries Department rushed a large force of men to the scene, and made strenuous efforts to clear the river. Before this could be done, however, the fish returned to the attack and again attempted to run the rapids. Fearing that after this second failure they would not make a third effort, the workers adopted a novel expedient. They built a temporary flume around the obstruction, and by using long-handled nets they ladled the fish out of the lower waters and dropped them into this flume, in which they could swim in quiet water past the blockade and out into the upper section of the stream. In this way, while nothing like all the salmon were enabled to reach the spawning grounds, enough did so to save the situation and make 1917 merely a light year, rather than a total failure.



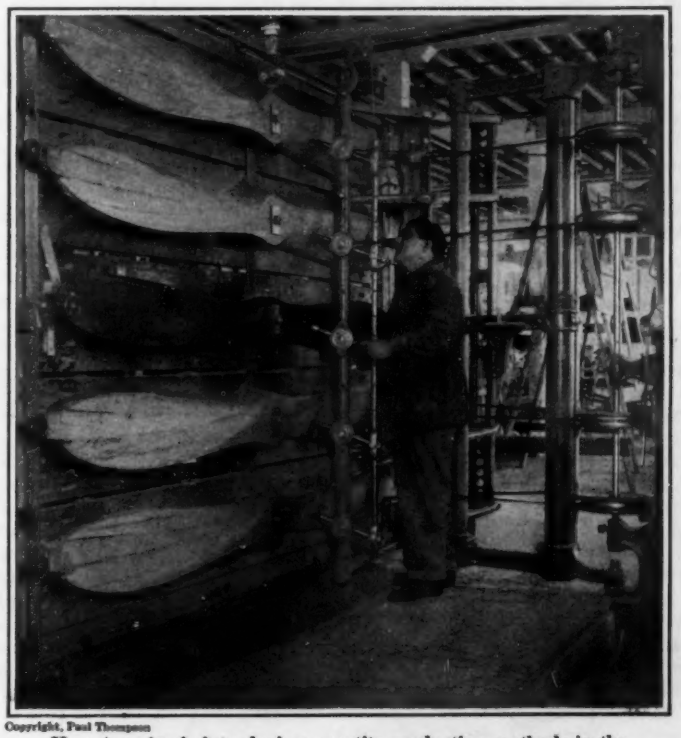
Helping the spawning salmon over a temporary barrier in the river, so that they might reach the headwaters and discharge their office

a muscular task. The work, however, was successfully accomplished. At the instance of the National League for Women's Service the photograph was made, with the young lady posing in Mrs. Davis's place since the latter did not want to appear in photographs.

How One Man Can Make Four Airplane Propellers at a Time

BEFORE the demands of this war introduced quantity production methods in airplane factories, the making of a propeller was a time-consuming and tedious task. Each propeller had to be fashioned by hand from a block of laminated wood, and there was no ready means of duplication.

But when thousands of propellers are required, not only to provide one for every airplane being built but also to replace those broken at the aerodromes back of the lines, means of duplication must be employed. So we find numerous schemes for making propellers in quantities with the minimum of skilled labor. A typical example of an airplane propeller-forming machine is shown in the accompanying illustration, and is in use in one of the American aircraft plants. With this equipment one man makes four propellers at a time. Guiding the middle arm over the surface of the master propeller in the center, he automatically guides the other arms and their cutters over the propellers being formed. The pantograph-like arrangement is fully counterbalanced and delicately jointed so that the lines of the master propeller can be followed with great fidelity.



Copyright, Paul Thompson

How America is introducing quantity production methods in the aircraft industry: A propeller forming machine

Tearing Up Roads to Build Better Ones

AT first thought the machine shown in the accompanying illustration appears to be a highly destructive one, since its sole use is the ripping up of roads. But the scarifier, as it is known, must needs be employed to tear up old roads before work can start on new roads. It plows up old roads and permits new materials and workmanship to take the place of a roadbed no longer fit for service.

Why the young lady running the scarifier? Well, here is the story: When F. H. Davis of Fresno County, Cal., was drafted, his wife took his place and handled a $50,000 road-building job. Personally, Mrs. Davis handled the scarifier, which, as is evident from the photograph, is rather

Making Wrought Iron by a New Process

A NEW method of making wrought iron has been brought out by a large Pittsburgh company. Highly refined iron produced by the Bessemer or open-hearth process, is disintegrated by any suitable milling operation that produces chips or shavings, and these chips or shavings are formed into a bundle and placed in a molten bath of silicate slag in an open-hearth or other suitable furnace, where the iron is allowed to remain until it has attained a welding heat. The bundle of iron with the adhering slag is then removed from the furnace and taken to the squeezer, where it is formed into blooms in the usual manner. Instead of forming the chips and shavings into bundles, they may be placed in the slag loosely, and after the iron has come to a welding heat it can be formed into a ball in the slag by means of a clam shovel or other suitable tool. Instead of chips and shavings of iron, fagots may be formed of iron rods, into the interstices of which the slag will flow. Or, under certain conditions, the cold slag and the disintegrated iron may be placed on the hearth of the furnace together, as the heat required to bring the slag to a molten state will at the same time bring the iron to a welding heat; or other forms of disintegrated iron may be employed. The iron may be brought to a welding heat before it is mingled with the slag. In certain cases other forms of slag may be desirable.

The advantages claimed are that the refining of the iron, which may be accomplished in large quantities by the Bessemer or open-hearth processes, is separate from the operation which incorporates the silicate with the iron; and larger quantities of iron may be treated by the process in an open-hearth furnace in one heat that can be puddled. The result is a great saving in time and labor.

This young lady is operating a scarifier, which rips up roads so that new ones can be laid

Restoring Communications with a Gun

ONE of the valuable means of communication which the Italians have employed in their mountain campaigns is the aerial cable. The most astonishing positions have been maintained through ability to slide supplies up to them along several miles of steel wire stretched high above an impassable country. In fact, the things which the Italian military engineers have accomplished with the "teleferica" as they call it, would make a book, and an absorbing one at that.

Perhaps as spectacular a "stunt" as any was the one staged when a *teleferica* was swept away by an avalanche, leaving a band of Alpini marooned high on the side of a glacier with only a few days' supply of food and ammunition. Their plight was not serious, because they could undoubtedly have made their way down in safety through their mountaineering skill; but they held an important position, and one which the Italian command was not willing to give up. Yet there were not nearly enough supplies on the little ledge to keep the party going until the cable-way should be repaired—a matter of a couple of weeks, at least; and while they could get down, there was no possibility of getting up again with supplies in the absence of the cable.

The somewhat daring expedient of shooting a cable up to them from a gun was suggested and tried out. The first attempt nearly proved disastrous; the weight of the cable deflected the chargeless shell to which it was attached by nearly sixty degrees, and sent it crashing through a mule stable—fortunately empty at the moment. A lighter cable still was heavy enough to make its shell go wide of the mark; in fact every attempt with a high velocity gun was a dismal failure. It was not until one of the new long range trench mortars was brought on the job that the experiment took an encouraging turn. Even then success was not won until the cable line was displaced by a light manila rope. This was fired to its goal—an eminence half a mile away and 1,000 feet high—at the first trial; and it served as a leading rope to drag up a light cable, which in turn brought up the heavy *teleferica* cable. In this way communication was restored the same day, instead of after an interval of weeks. Our cover illustration this week depicts the situation.

Spectroscopic Parallaxes

MOUNT Wilson Observatory is making rapid progress in determining stellar parallaxes by the spectroscopic method. The observatory will shortly publish the parallaxes of about 500 stars.

Strategic Moves of the War—May 1st, 1918

By Our Military Expert

THE great battle that raged in the north from the beginning of the month and that can now be called the battle of Flanders died down three weeks ago with the question that every one asked as to where the next blow might fall. It is quite opportune here to give a brief resume of what has happened since the beginning of the great German thrust. The most stupendous conflict of this world war has now been under way since March 21st or for more than six weeks. It has been universally described as the decisive battle; the Kaiser has termed it "the decisive moment of the war and one of the greatest moments in German history." It will be decisive for Germany if the objects of the thrusts can be obtained: first—to drive a wedge between the French and English armies so that each could be beaten separately as opportunity offered; second—to take the Channel ports such as Dieppe, Etaples, Boulogne, Calais and Dunkirk, through which English reinforcements and supplies are brought. Their loss would be almost fatal to the safety and efficiency of the English forces.

To carry out the plans laid down by the German General Staff, the best troops of the German armies, led by their ablest generals, have been assembled under the personal command of the German Emperor and directed by von Hindenburg and Ludendorff, who are the ablest strategists on the German side that the war has produced. But, up to the present, the fighting has been a drawn battle with the disadvantage to the Germans that their enormous losses in man power cannot be repaired by new drafts if the war continues into the next year. More than four millions of men have been engaged in the present struggle on a front of approximately one hundred miles. The best obtainable information so far gives the Germans 210 divisions or two and one-half millions of men. The Allies have about one hundred and ninety divisions; but, as the average strength of each is greater than with the Germans, the number of men is fully equal to that of their opponents.

As the French General Foch is supposed to have kept in reserve for his "army of maneuver" about sixty divisions that have not yet been brought into battle, it can be well understood why the Germans have been able so far to attack with overwhelming numbers at all points of contact. The French General Staff, than whom there is no body of men more efficient in the science of war in any army, had already indicated the probable points of attack. First, the Germans could endeavor to break through the junction point of the French and British lines by moving forward from St. Quentin front. If successful here, the British would be driven north toward the Channel, isolated, and defeated in their turn. Incidentally, Amiens would be captured with its enormous depots of supplies as, due to its railroad facilities, it is the principal British supply depot. Second, the Germans could attack the French on the Oise and, by defeating them, march on Paris after separating them from the British. Third, the Germans could attack the British between Arras and Ypres with the intent to defeat them before the French could come up with reinforcements; if successful here, they could cut communications with the Channel ports.

The Germans originally selected the first plan and, by striking suddenly and with overwhelming strength, they forced the British back until the extreme point of the German wedge was only nine miles from Amiens. Had the British lines broken, nothing would have saved Amiens and Abbeville, the important British supply depot; and, if the Germans kept the Somme Valley on their left flank, the English could have been pushed up in the north and cut off from French support. But the English lines were not broken and the Germans were held through Albert, Montdidier, and Lassigny to the Oise and Aillette Rivers. While ground was gained over a distance of thirty-five or forty miles from St. Quentin toward Amiens, it was a devasted territory and had been conquered only with the loss of two hundred and fifty or three hundred thousand of the best German troops. In fact, the losses were so great that eighty or ninety divisions had to be withdrawn for rest and reorganization. The German commander had played for great stakes; while successful on the surface, in reality he had lost out, because all movements in this part of the field were brought to a standstill.

Having failed here, the next move was to try to break through north of the salient near Armentieres where the British and Portuguese lines joined. Here it was hoped that lack of unity of command would permit of making a break and of forcing the troops of each nation to consider only their own front. By assembling there thirty or more divisions, thus allowing seven or eight thousand men to a mile front, the British were forced back by sheer weight of numbers; but their lines were never broken through. Although the Messines and Paschaendaele ridges on this part of the front, which had been taken last year by the British after superhuman efforts, were outflanked and had to be given up, equally advantageous positions farther back were occupied and the Germans were held for a time. But fighting was renewed here a week ago and, despite the greatest bravery on the part of the English and their French supports, Mount Kemmel was also taken. Ypres has thus been placed in a most dangerous salient for the Germans can overlook the plain to the north on which the city stands; it seems almost certain the English must abandon this ground, which strategically is now of little value. The attempt to hold the town under present conditions would seem to be more sentimental than of any military value especially since there are to the west some positions fairly good for defense. But under present conditions a retirement here must also be viewed as giving the Germans one more step toward the Channel ports, unless they can be driven from their present dominating ridges in this part of the battle lines. From the nearest point of the present German lines to Dunkirk on the coast is only 28 miles; if they can advance farther in this sector, there must be without doubt an entire readjustment of the English lines; for the present outlook presages far-reaching consequences, now that the Germans are practically out on the plain country to the west, where opportunities for such strong defensive methods on the Allied side are much fewer.

So far the third phase of the great battle has developed three objectives on the part of the Germans:

First—to break the defenses of Ypres by capturing Mount Kemmel, which now has succeeded. However, since this, the main German thrust has been held here

The line through the hills west of Ypres

and has ended. The northward movement of the fighting indicates an attempt to overrun the Ypres plain before moving west against the heights.

Second—to capture Bethune and break the British hinge now at Givenchy. This has not yet been accomplished.

Third—to capture Amiens and thus outflank the British at Albert and Arras.

For the past three or four weeks the Germans have been concentrating troops and guns behind the front facing Amiens; and, when the drive was begun in the north, an advance was also begun straight at Amiens by a drive through Villers-Bretonneux and Hangard, the junction points of the British and French lines. At first, some success attended the advance; but the latest reports indicate that all ground has been regained and the British and French are successfully holding back the enemy. The first round of the struggle has given the Allies here renewed confidence; and, if maintained for any length of time, it will bring about a reaction of the extravagant German hopes of a decisive victory. The great hope of the enemy has been the capture of Amiens and the separation of the British and French armies, with all that would mean in the way of breaking the combined resistance of the two and making it possible for the enemy to deal with them piecemeal.

Just now this great battle in the west is shaping itself more and more after the Verdun pattern. Except between Arras and La Bassée, the entire line from the Aillette and Oise Rivers to the North Sea has been tried out for weak spots; one was found opposite St. Quentin, the other around Ypres. But that clearly defined breaks anywhere can be made must not be expected. It is the backward and forward move of Verdun all over again, the shove and push that finally led to the dead halt there and then to a final German withdrawal. In the present case it is a greatly enlarged Verdun for the front is four times as long and the numbers engaged four times as great. The present battle has been as well advertised as the Verdun advance; but it means to the Central Allies still more. Not only is Germany throwing into it all her own available strength, but the aid of Austrian and Bulgarian troops has also been called in. In fact it is a question for the combatants of bleeding one another white. It would now seem that everything depends upon the powers of endurance of each; the supreme test should come at any time. On the part of the Entente, there have been foreseen the furious nature and extent of the German attack and the prolonged nerve-racking tests of reserve power. If the French commander is now holding his reserves, probably he foresees a determined attack along the Aisne front, in the Champagne, or in Lorraine. He refrains from moving until he can see clearly revealed to him all contingencies on the front from the North Sea to Switzerland and can act accordingly: for he dare not commit himself to any single locality until the German power of initiative is checked.

On the southern front toward Amiens the Germans are certainly placing themselves in a dangerous position for the more they advance the more they are exposed to a crushing in of the salient on one side or the other, especially as, up to the present time, the Allied reserves are intact and can be moved quickly where most needed. The thrust here, as well as to the north, appears to have one or more objects—viz., to break the junction of the French and British forces and to wear out the British army. So far neither has succeeded and there is no present prospect of any decided carrying out of these plans. While there have been gains in the north and serious threats against parts of the lines there, there can also be but little doubt that a strong offensive will be tried again between Amiens and Arras to break the British lines and to separate the English and French. Good policy would also indicate that a strong thrust be made by the Germans between Arras and La Bassée for gains of ground here would allow a spreading out of the masses of men now crowded in salients with no elbow room and under great difficulties to obtain supplies.

Since the capture of Mount Kemmel, two days ago, the German offensive has slowed down, evidently with a view of reorganizing after the four days' battle and giving to the tired troops a needed rest. Both sides are making preparations for a renewal of the battle, which is certain to begin again soon, by bringing up guns and men to repair losses and to strengthen the lines. All along the various lines there have been heavy artillery firing and continuous raids on both sides. It now appears from the latest information that the German losses in the advance around Ypres have been large in the extreme—probably four to one of their opponents; those who have seen the field of battle around Kemmel describe it as a slaughter pit. It must be borne in mind, however, that in this tremendous struggle gain of ground is only a secondary consideration; it is therefore evidently the French commander's object to preserve his strength by sparing his men as much as possible and to obtain a maximum toll for every casualty on his own side.

If the German losses continue much longer to be as great as in the past six weeks and if strategic successes are as slow as heretofore, it is only a question of a short time when their commanders will be compelled to move with great caution. So far the Germans have maintained the initiative, showing that up to the present they have a numerical superiority as well as fair lines of communications. The Allies are credited with assembling slowly a large reserve army of men and guns; but heretofore the Germans have been able to concentrate their troops more quickly. So far as the great objective of this campaign is concerned, viz.: the taking of the Channel ports, many weeks of fighting will probably pass before that could be attained. There is only a small chance of success; but, with even that chance, the Germans will no doubt try to obtain it. For the Allies there is one serious situation developing and that is the constantly diminishing area in which their troops can maneuver. As stated above it is only 28 miles from the nearest point of the enemy's lines to Dunkirk and only 38 to Calais. When it is considered that thousands of men with their supplies must maneuver in the area between the present lines and the coast, it will be seen there is very little free space behind them. Present conditions show that Field Marshal Haig spoke truly when he said the Allies were fighting with their backs to the wall. But, on the other hand, before the Germans can reach the Channel they will be near the point of exhaustion with no reserves; they must win a crushing victory this year or they must make peace.

The San Diego Aviator Factory

Preliminary Training of Our Flying Men at a Leading School

By Edward C. Crossman

NOT many moons ago our short-sighted Uncle Sam maintained, on the spit of land in San Diego Bay known as North Island, a somewhat aviation school. It was known to the dear people chiefly by the occasional squibs in the press announcing that some unhappy victim of Congressional parsimony had made a much faster descent from the blue empyrean than is contemplated in present airplane construction. It was known to professional flying men as the harbor for various antiquated craft of the same class among airships as the famous "Santa Maria" of Christopher Columbo is among watercraft. It was this school that saw depart, over the blue mountains to the east, the worst lost pair of aviators that ever aviated—the two army gentlemen who set sail for Calexico in the Imperial Valley over the mountains and who finally wound up more than a hundred miles beyond, in Mexico, in the most desolate, least inhabited and most dangerous region adjoining the border of these United States.

So it came about that the aviation school at North Island didn't wear any impressive reputation on the Pacific Coast and the name may even now arouse entirely erroneous ideas in the minds of those reading of it and its work. The island and its name still remain, but all else is changed. From a one-horse, purely experimental and mostly forgotten branch of our army's posts and schools, North Island at San Diego has been suddenly metamorphosed, in this sixth month of the first year of war, into one of the greatest training schools in the world for aviators. Not that the graduate of this school is fit without more ado to take on Guynemeyer or the Teuton flier with two-score French scalps to his belt. North Island is merely the second step along the road toward the "Ace" stage of aviation. Other schools take the junior military aviator and introduce him to the upside down and the loop-the-loop, and the whirling leaf and other stunts that serve to undo Hans and Fritz in the air.

North Island, however, situated in the best possible climatic location in these United States, grinds out junior aviators as steadily as a big plant grinds out munitions. Practically devoid of high winds, blessed by little more than ten inches of rain per year and that falling within sixty to ninety days during the winter, the San Diego climate sees the fliers starting morning after morning at the magic hour of six-thirty, while the bulletins from the eastern schools growl dispiritedly about rain or snow, or blizzards, or high winds and muddy fields. The school finishes off the raw material supplied by the theoretical school up at Berkeley, converting these novices into men who can do any ordinary sort of flying, who understand gas engines as thoroughly as any man can understand the moody, tricky and inconsistent beasts, and who are ready to learn the gentle art of the aerial gymnastics that cause the fretful hair to rise on the scalp at the mere reading of the accounts thereof.

SOME eight months ago Mr. Crossman submitted this article to us. At that time it told of the latest developments at the San Diego flying field. For obvious reasons the publication of this information has been withheld until now, and the article is presented in its original form.—THE EDITOR.

Now, instead of the solitary, uncertain, wobbling, unreliable machine that used to circle around the fields across the bay from San Diego, the sky is full of pale yellow dragon flies, while the roar of the great eight-cylinder motors reaches over to the business district. Nearly two-score of the planes circle the fields in solemn procession during flying time in the early morning, while often there sails over the city itself the straw-colored, translucent plane of the more advanced student, and the staccato song of his motors floats down from his mile elevation.

The island is so-called because it is a promontory. San Diego Bay is formed by the curving highlands of Point Loma on one side, and by the long, low sand-spit of Coronado and North Island on the other. The latter forms the northwest termination of this 10-mile spit.

Said spit, running from the mainland some ten miles to the south, is but a few hundred yards wide for much of its length. At its northern end it widens to several miles, and this is the beautiful little suburb of Coronado. Then it narrows down again, pinching out beyond the hotel to a mere strip of sand across which the water floods with the right combination of high tide and high wind. Beyond this little neck, it again widens to make North Island, several miles each way, and forming one side of the entrance to San Diego Bay—of which Point Loma is the other. It is but a scant mile from the city of San Diego and is surrounded by water on every side save the little neck mentioned that links it with Coronado. One side is washed by the placid waters of San Diego Bay, another by the harbor entrance, and a third by the more boisterous waters of the open Pacific, with only the highland of Point Loma reaching out in its curve to stop the long roll of the open sea.

The San Diego climate is without doubt the most even and the mildest of any city in the United States, having a mean of 60, a low temperature in winter of 54, and a high one in summer of 68. There are few cloudy days and little rain, while high winds are mostly absent. As a combination of ideal climate and location, the North Island Aviation School is more nearly ideal than any other such institution in the world.

In this Uncle Sam agrees. Already there have been drawn tentative plans—blue prints of which hang on the walls of the office of the school—for the only joint aviation school in this country for the army and navy, Some four million dollars are to be expended in the buildings and the improvements. The army is to have the sea side of the island, the navy the bay side, where the waters are ironed out and so adapted to the navy hydroplanes. Each branch is to have its own hangars and shops and offices. Work is expected to start on the army buildings about November 1st. The plans include specifications for handsome quarters for the officers of the school along the mission style—which is not used for more than three out of four buildings in California—with hospital, barracks for the enlisted men and noncoms and others for the cadets attending the school, with the usual buildings of the army post, and in addition with machine shops and wood-working shops,

(Continued on page 438)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Nose Spin

To the Editor of the SCIENTIFIC AMERICAN:

Investigations into the numerous airplane accidents of late reveal that by far a larger part of these accidents are the result of the machine going into a nose spin, or as the average press reporter would have it, a nose dive. The nose dive itself is not necessarily dangerous. I have seen this executed time and again by even the less experienced flyers with no hint of danger and it is extremely doubtful if this spectacular stunt has been responsible for a single accident unless some part of the machine was at fault. The nose spin, however, is extremely dangerous and is almost certain of disastrous results. It is practically the same as in the nose dive except that instead of the machine diving straight to earth as in the nose dive, the planes revolve about the axis of the propeller horizontally like the arms of a machine governor. In this position the controls are useless, in fact they only tend to increase the rotary motion of the planes.

While the death rate among flyers is gratifyingly small considering the number of comparatively inexperienced men involved, it is doubtless the desire of the officials in charge to reduce these accidents to the smallest figure possible, and scientific research and discussion of the subject will no doubt, in due course of time, bring about the results desired.

In solving the problem of the nose spin it will,of course, be necessary first to determine the exact cause, before attempting to apply a remedy. In my opinion it is unquestionably due to the machine going into a nose dive under full power and the propeller torque causing the planes to rotate horizontally about the propeller shaft.

This theory is substantiated by the fact that the direction of the planes' rotation is always opposite to that of the rotation of the propeller. Another fact which would bear out this theory is, that a pilot can voluntarily execute the nose dive successfully, but when a machine suddenly goes into a nose dive unexpectedly it is reasonable to suppose that the spin has already begun before the pilot has had time to switch off his motor. Once this spinning motion of the planes is started there is little that the pilot can do to save himself.

Assuming that the above theory is correct it would seem that a solution of the problem would be to equip each machine with an automatic device for short-circuiting the motor when a certain forward angle of the machine is assumed, or to provide a reversing mechanism for the propeller shaft or the propeller pitch, with which the pilot could set up a reaction to the spinning motion once he found himself in that dangerous predicament.

GEO. W. WILLIAMS.

Temple, Texas.

Papers for Bagdad

To the Editor of the SCIENTIFIC AMERICAN:

Since the occupation of Bagdad and Mesopotamia by the British army, and the opening up of communications with the outside world via Bassorah, the local merchants are beginning to look about to make connections in order to replenish their depleted stocks of merchandise. The local British authorities are also taking an active interest in developing the country and have a number of projects in hand for introducing more modern methods of farming and irrigation.

With a view of bringing to the attention of the persons concerned the advantages of the American market I desire to open a reading room in the Consulate and would be glad to have your publication on file. The Consulate is not able to purchase the papers, however, and I wonder whether some of your readers would not send us their copies after reading them. The address is simply,

"American Consulate,
Bagdad, via Bombay, India."

OSCAR S. HEIZER,
American Consul.

Bagdad.

A New Lifting Force for Airplanes

To the Editor of the SCIENTIFIC AMERICAN:

Regarding the additional lifting force for airplanes mentioned in the article by Mr. Hering in the SCIENTIFIC AMERICAN of March 9th, this is no doubt appreciable, due to the fact that the air stream, by its friction on the surrounding air carries a considerable portion of that air with it and the rush of air to fill the partial vacuum thus created, causes air currents from all sides towards the axis of the propeller stream.

The propeller stream can be bent in any direction merely by stopping the compensating air flow (with a suitable plane of some kind) on the side toward which it is desired to attract the air stream. I think the writer is wrong in supposing that the air stream will support the force of the compensating air currents on the other side of the air stream from the intercepting plane and it is only because of the convex formation of his card that he got any appreciable lift in his experiment as indicated in Fig. 4. This was due to the fact that the air current on one side of the card struck a convex surface, while the current on the other side encountered a concave one; the pressure on the concave surface being slightly greater (a fact recognized in the Robinson anemometer).

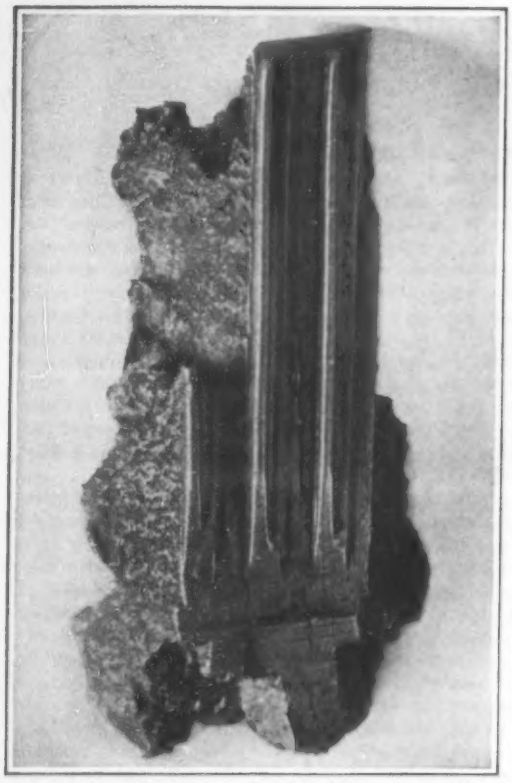
However, this force holds good only when there is a considerable displacement of the medium and the object is nearly at rest. With an airplane, during flight, the medium is more nearly at rest and the object moves forward through it; so the actual lifting force due to the air stream would be comparatively small. In addition to this, the bending of the propeller stream would cause a loss of the negative pressures over the rear part of the wing, thus counterbalancing any advantage gained by the lifting force mentioned.

Suppose it were granted that this force is sufficient to actually lift the machine in the air, under full propeller action, provided the airplane were hitched with a rope from behind. The moment the rope were cut and the machine moved forward, it would descend to the ground, on account of the diminution of the lifting force (the force being at its maximum when the machine is at rest) and by the time it had attained sufficient speed to rise on its wings, the force (which would diminish with the forward motion of the machine) would be comparatively small and what there was left of it would be neutralized by the loss of the negative pressure on the rear part of the wing, as indicated above.

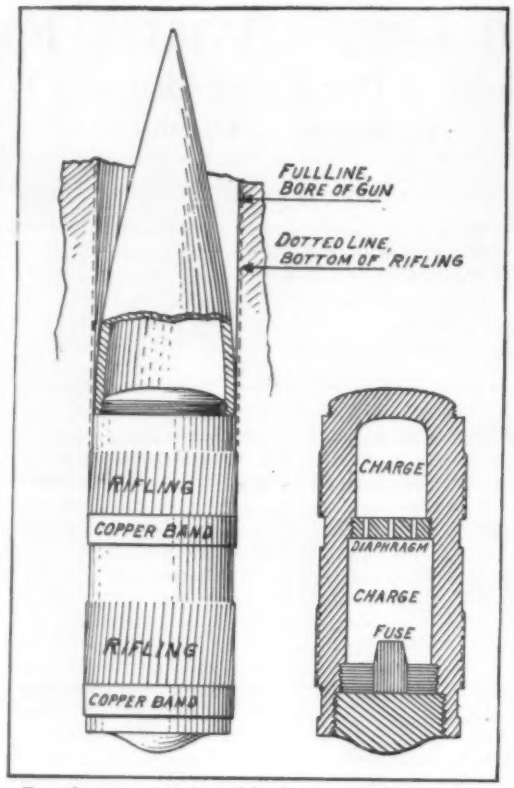
I would like to hear how nearly right I am in my line of reasoning.

JULIUS A. PAYNE.

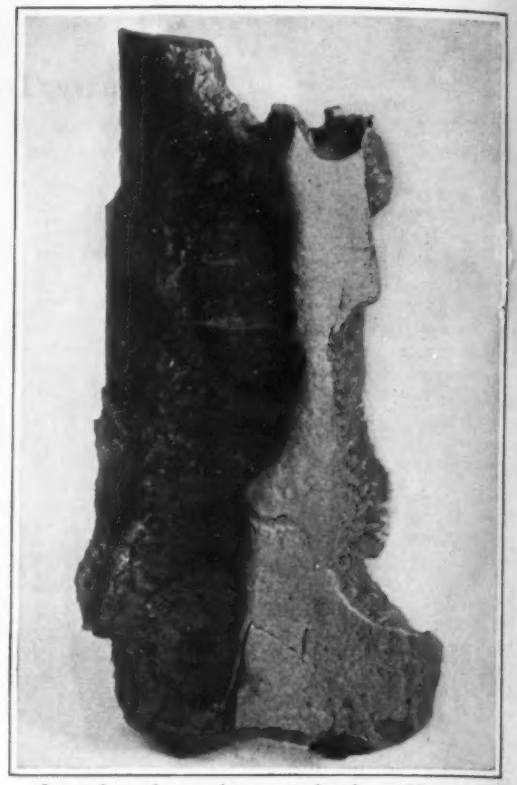
Philadelphia, Pa.



Outer face of fragment showing rifling, apparently machined in the shell



French reconstruction of long-range shell, based on recovered fragments



Inner face of same fragment showing evidence of fusion under great heat

The Seventy-Five Mile Gun

A Study of Shell Fragments Recovered in the City of Paris

A SUFFICIENT number of fragments of the shells which have been thrown into Paris from the forest of St. Gobian have been recovered to make it possible to reconstruct a complete shell. This has been done, and drawings of the shell (herewith reproduced), have been published in *L'Illustration*, accompanied by an article from the pen of the well known writer, F. Honoré.

It seems to be agreed among the French artillerists that the shell weighs 220 pounds and that its caliber is 8.2 inches. This last is one of the standard calibers of the German ordnance manufacturers; and we think it probable that these are the correct size and weight. The shell proper is about 20 inches in length, and its walls are 1½ inches in thickness.

M. Honoré is of the opinion that, although the initial velocity is high, it is not excessively so; and he bases his conclusion upon the laws governing the air resistance encountered by swiftly moving bodies. The atmospheric resistance at medium velocities of 1,200 to 1,500 feet per second increases as the square of the velocity, and at the higher speeds increases as the cube or fourth power, or even a higher power than that. He points out, on the other hand, that this resistance decreases uniformly with the decrease in density of the air—that is to say, with the increase in altitude. A suggestion that this decreased resistance is greater than has been supposed, was found in the French experiments with a 380-gun, whose shells attained a height of 8 or 10 kilometers, with an increase of 10 per cent over the calculated range.

The two photographs which we publish of one of the shell fragments have made it possible to reconstruct the shell with a considerable degree of accuracy. There can be no question that, to throw a projectile of this size and weight to a distance of 75 miles, it is necessary to use very high muzzle velocity. If, as we suggested last week, the Germans are using a 15-inch, sub-calibered navy rifle for the purpose, it is certain that, because of the great length of the gun relatively to the sub-caliber bore, it would be possible to get the necessary velocity without using destructive powder pressures. Since they are using the 8.2 shell, the 15-inch navy gun will have a length, for that shell, of over 90 calibers. But even with such length of bore, it has probably been found necessary to use a powder pressure much higher than the normal, which is from 18 to 20 tons to the square inch. With high powder pressures, the problem of sealing the base, so as to prevent a rush of the gases past the shell, becomes more difficult, and hence we find that the Germans are using two copper bands—one near the base, and one well forward of the center of length of the projectile. Furthermore, the shell fragments seem to reveal the fact that the Germans have had trouble in making the rifling bands stand up to their work of giving the needed rapidity of rotation to the shell, for in front of each copper band a series of grooves has been cut in the shell to match the rifling in the gun.

There is nothing novel in rifling the shell, for, as a matter of fact, in the early days of the development of rifled ordnance in Europe, and particularly in England, the projectile was provided with studs made of a soft metal, such as zinc or copper, which served to take the rifling of the gun and give the desired twist. Another method we may mention here was to make the bore of the gun hexagonal and form a corresponding hexagonal surface on the shell. A well known example of this was the Whitworth projectile.

We are told that the pieces of the projectile which have been recovered in Paris are of very fine metal, extremely hard and showing a shiny fracture. The metal had not been analyzed at the time M. Honoré wrote, but it seems to be in the class of vanadium steels. Recovered fragments prove the shell cavity is divided into two portions by a heavy horizontal diaphragm, which is perforated. It seems that this arrangement is similar to that used in the 420-inch German shell, and it is supposed to be done in order to diminish the heavy compression set up by the explosive filler due to its inertia when the shell is fired. According to this French authority the action is sufficient sometimes to cause premature explosion. This is rather puzzling, because the shell filler that we use is absolutely insensible to shock—in fact, it is capable of being carried through a thickness of armor equal to the caliber of the shell without detonating. In the days when black powder was used as a filler, it sometimes happened that shock would set off the charge before the shell left the gun.

The fuse is at the base of the projectile, which is closed by a double plug. The base of the projectile is somewhat rounded, supposedly to offer some helpful effect in reducing air resistance. The nose of the projectile, it will be noticed, is not ogival but blunt. It is threaded on its periphery, and upon the head is screwed a light, steel, false nose, the curve of which is struck with a very long radius. This false head, of course, is nothing new, and in fact, it is used in most of our large modern projectiles. Its object is to reduce head resistance, etc., and tests have shown that a false head of this kind will greatly extend the range.

The light weight of the shell, the rifling cut in the shell itself, and the double gas check provided by the two copper bands, present cumulative evidence that the powder pressure is high and the muzzle velocity also.

The bombardment of Paris has been carried on in a desultory fashion, with intermissions which suggest considerable trouble with the gun itself. It has been stated by Paris dispatches that one gun has burst and that another has been put out of commission by the French heavy artillery, leaving only one of the original three in operation. Be this as it may, we venture to predict that, because of excessive erosion, the life of these guns will be short and their firing erratic. The Parisians still continue to view the gun with more interest than fear, and as M. Honoré states in his concluding sentence: "This gun is but a magnificent instrument of bluff; its military value is zero; and its life appears to be limited to a mere score or two of shots."

Why Platinum Had to be Conscripted

THE answer is, briefly, because it would neither enlist nor submit voluntarily to a selective draft. Many metals have and are being used wherever it is believed they can accomplish most but platinum was reluctant to forsake the people and ways of ease and become a producer.

It has been stated that about 5,000,000 ounces of platinum has come upon the market since it began to be mined and of this 20 per cent has gone into dentistry with another 20 per cent into jewelry. The world's annual production is normally a little more than 312,000 ounces of which something over half comes to America where it becomes nearly equally divided between dentistry, jewelry and science and industry. Ninety-five per cent of the world's supply is Russian, Colombia being the second largest producer followed by the United States, Australia and Borneo, with an unimportant amount scattering.

Before so many uses were found for platinum it was much cheaper than gold and at one time counterfeit coins were made of it in Russia and gold plated. In 1888, when Russia changed from trimetallic to bimetallic coinage, it could be had for $6 per ounce and at times since the market has fluctuated widely.

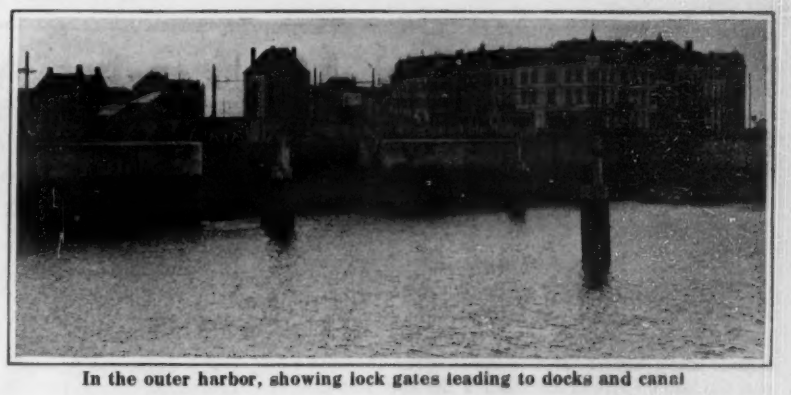
Its infusibility, resistance to corrosion and chemical attack, its coefficient of expansion and electrical conducivity make platinum practically indispensable in science, while its peculiar properties make it a "key" material in the production of sulfuric acid. The value therefore soon exceeded gold and forthwith platinum became the thing for articles of adornment. Then up went the price and that created more of a demand. The price again rose, also the demand and so on ad infinitum.

Substitutes have been diligently sought and found for some things. Others have not been interested in substitutes and so, since we must win this war to have anything else matter, we shall have to send our platinum now worth above $90 per ounce to the laboratory and through chemical manufacturing to abide for some little time to come. In these times it looks just right as contact masses in acid plants, concentration apparatus, contact points for motors, parts of delicate electrical apparatus dishes, crucibles, electrodes and what not for research and control laboratories. In such use very little platinum wears away and may be some day a large part of it may be given an extended furlough.

Conservation of Ammonia

NITROGEN fixed in nearly any form has assumed unusual importance under war conditions. The conservation of ammonia, which is used in vast quantities for artificial refrigeration, becomes very necessary. The users of ammonia for this purpose are being urged to pay special attention to their insulation, possibilities of the gas escaping and any other details of their equipment that can be improved so that refrigeration may be carried on this year with less ammonia than ever before.

The Mole, Zeebrugge, which was raided and partly destroyed

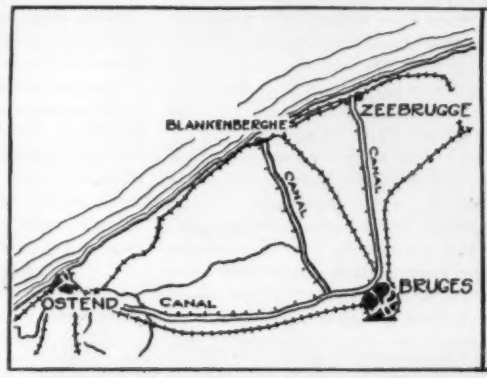


In the outer harbor, showing lock gates leading to docks and canal

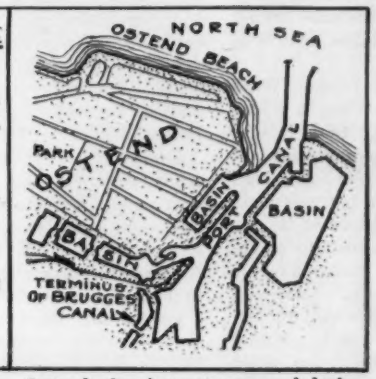
The Attack on Zeebrugge and Ostend

Brilliant Bottling-Up Expedition Against the German Submarine Bases

THOSE critics who have been calling for a strong offensive against the German submarine bases must have received their fill of satisfaction when they read of the dashing exploit of the British navy against the German bases at Zeebrugge and Ostend. Germany could not have been struck in a more tender spot; for her writers, both military and naval, have always tried to impress it upon the Germans that the possession of the Belgian coast is of prime importance in Germany's plans for the crushing of British sea power. German hunger for the possession of the Channel ports is largely responsible for the present fierce drive against the northern sectors of the British army in France, and should she succeed in adding Dunkirk, Calais and Boulogne to Zeebrugge and Ostend, she will fight to retain them more fiercely perhaps than for any other object in the war.



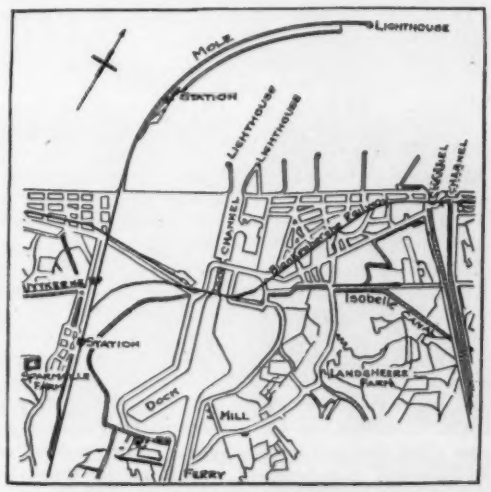
Relation of Ostend and Zeebrugge to Bruges



Ostend, showing entrance and docks

The value of the two Belgian harbors lies in their strategic relation to the English Channel and the southerly half of the North Sea. Zeebrugge is the port of the considerable city of Bruges, with which it is connected by a canal which also extends between Bruges and Ostend. These conditions render both of these ports admirable bases for submarine operations; for the craft can lie in the canal beyond range of hostile gunfire from the sea. The approaches to both ports are characteristic of the waters of the Belgian coast, which are shoal and underlaid by shifting masses of sand through which channels lead from deep water to the harbor entrances. Zeebrugge is protected from southwest gales by a curved breakwater or mole of masonry, which is connected, at its in-shore end, with the mainland by a bridge. The entrance to the docks of the canal is formed by two smaller breakwaters with a lighthouse at the end of each. About three-quarters of a mile in-shore are the lock gates which form the entrance to the docks and to the canal.

Ostend has no large breakwater, the entrance to the docks and to the canal from the sea being formed by two piers, about one-quarter and one-half mile in length, and the harbor being a tidal one, there are the customary lock gates leading to the various docks and basins.



The Mole, entrance and docks, Zeebrugge

Both Zeebrugge and Ostend have been subjected to attack from the air by the British Naval Airplane Service, and considerable damage has been done from time to time. Latterly, as protection, the Germans have built heavy reinforced concrete shelters, under which the submarines lie during their overhauling and refitting.

The expedition, which was under the command of Admiral Keyes, was most carefully organized; and the various vessels that went into the harbor were manned entirely by volunteer crews. There is some doubt as to the exact composition and size of the attacking fleet, but judging from the rather fragmentary reports which have come to hand, it looks as though the fleet of raiding ships was accompanied by a considerable force of monitors armed with 12- and 14-inch guns which subjected both bases to heavy long-range gunfire before the raiding vessels were sent in.

The fleet detailed for the raid consisted of five obsolete cruisers from twenty to thirty years old; the "Vindictive" under command of Commander Carpenter; two large ferryboats which formerly did service between Birkenhead and Liverpool; two old submarines filled with explosives; and several destroyers and high-speed motor-boats.

The "Vindictive" is a protected cruiser of 5,750 tons and 20 knots speed, built in 1897, mounting a battery of ten 6-inch guns, and nine 12-pounders. Her complement is 450 men.

The five obsolete cruisers, loaded down with masses of concrete, were designed to be sunk across the channel entrances so as completely to block them.

The two old submarines, which were crammed with explosives, were destined, one for blowing up the bridge connecting the in-shore end of the mole with the mainland, and the other for blowing up the lock gates, and so draining the docks and basins and the canal itself.

The plan of attack was for the "Vindictive" and the two large ferryboats to lie alongside the outer wall of the mole and throw landing parties ashore, mainly for the purpose of diverting attention from what was being done inside the harbor, and partly for the purpose of destroying the batteries and the considerable amount of military stores located on the mole. Under the cover of this distraction, three of the concreted cruisers were to make their way through the harbor and sink themselves squarely across the channel.

After the preliminary bombardment by the monitors, which was so heavy that windows were shaken in the town of Dover, some seventy-five miles distant, the fleet advanced behind a screen of smoke. A change in the wind lifted the smoke screen just before the fleet reached its objective, and German star shells revealed to the enemy the daring nature of the attack. The "Vindictive" reached her objective, and with lines of grappling irons managed to get ashore two out of 14 special gangways—the other dozen having been shot away—which were stretched from the ship to the elevated parapet of the mole. Over these the crew from the "Vindictive" swarmed ashore where they were joined by other landing parties from the ferryboats. They captured the guns on the mole, and turned them on the Germans, driving them back, and covering the line of warehouses, which were set on fire by flame throwers that had been provided for the purpose. The "Vindictive" was brought under extremely heavy gunfire, but thanks to the protection of the mole, only her upper

(Concluded on page 442)

The ancient town of Bruges, showing canal

A stretch of the Zeebrugge-Bruges canal

All photographs copyright by Underwood & Underwood

World Markets for American Manufactures

Conducted by WILLIAM W. SNIFFIN

A department devoted to the extension of American trade in foreign lands

Gunning For Foreign Customers

By Crittenden Marriott

THERE are of course a multitude of happy accidents which may throw export trade into one's lap most unexpectedly; and connections thus founded frequently enlarge and prosper. But in the long run the man who gets the lion's share of anything is the man who gets up early in the morning and goes out gunning for that thing; and this applies as well to foreign trade as to anything else. Such a philosophy, however, in practice involves more or less serious inconvenience; a citizen who contemplates a gunning expedition must have a gun, and he must know what to do with it.

Here is where a lot of would-be exporters fall down. Sometimes they think they have a gun, only to discover, eventually, that it was nothing more than a Governor's Island broomstick, and a damaged one at that. Sometimes they have a sure-enough gun, but one that is not in working order. And sometimes there is nothing whatever the matter with the weapon, but the man behind it is deficient in knowledge of its mechanism or skill in its handling.

All of which is by way of being what Artemus Ward would have characterized as a "parabolic" way of saying that a deliberate effort to capture foreign trade implies that the man behind it has a definite plan of campaign in mind, and one which he is capable of carrying out. That is to say, firms which went after foreign business more deliberately in the early days were confronted at the outset with the necessity of choosing a method of approach. Most of them tried one or two methods before they found one that was satisfactory. Moreover, methods that served well in one business in one country did not serve so well in another business in another country. Jewelry, rice, paints, and machinery could not be sold in just the same way in South America, Russia, Europe—or in the United States for that matter. Methods had to be evolved and evolution was usually costly.

Today conditions are different. The various fields have been explored and are no longer mere names. It is usually possible for a would-be exporter to find some one who is selling goods kindred to his own in the country into which he desires to venture. Nearly always he can find some native of that country who knows general trade customs there; and often he can find men who in addition to knowing customs, are more or less acquainted with the particular line of goods that is to be exported. Large firms today seldom go into foreign trade until they find an expert to manage that end of their business; they find it cheaper in the end. Small manufacturers who cannot afford to pay high-priced experts can get from the "trade advisers" of the State Department a wealth of information as to the methods best adapted to any particular goods and any particular country they may have in mind.

There are of course many things that a manufacturer must consider before embarking on foreign business. One of the most important is the ability to obtain credit information when it becomes necessary. This problem has now been pretty well solved. The standard agencies can give very full and accurate ratings in a very short time. So far as South America is concerned they can usually do it as quickly as they can for firms in the United States.

An export end may be organized on several plans. Salesmen may be sent direct; local agencies may be established; joint or coöperative representation may be arranged with other manufacturers; arrangements to sell on commission may be made with established export houses; catalogues may be sent to names judiciously chosen from directories or other lists. Another method, not often used, for it takes a lot of brains, is to catch foreign representatives while they are in the United States.

Salesmen are always best if the right sort of men can be obtained, but they are of course, rare and expensive. Local agents are often very successful, but competent men are not altogether easy to secure, and it is necessary to take care that in addition to being energetic they shall not be carrying too many lines or trying to cover too large a territory. Joint representatives have often proved very efficacious, but they should be restricted to cognate lines so as to get the maximum of results for each of the coöperating firms at the minimum of effort and expense. Export houses are very well for sporadic work, but to sell through them is unlikely to lead to the establishment of a permanent business to which the manufacturer's name can be attached. Catalogues and follow-up letters are cheap, but of course they are hit or miss; most firms that have tried them insist that a basis of personal acquaintance or of confidence due to introductions is a condition of precedent to their successful use.

Local agents have the advantage of knowing the people, the language, and the business customs, but are generally deficient in the teachings of the particular business involved. This, however, can be remedied. A Boston firm attempting to introduce its line into Argentina received a communication from a live young fellow in Buenos Ayres offering to act as its agent. The firm made inquiries and found that the man had a good reputation and some capital and came to an agreement with him. Immediately the Argentine man went to his chief and practically his only competitor in Buenos Ayres and entered into partnership with him; then he left him in charge and sailed for Boston. Once arrived, he went to the exporters and spent six months in their factory working and learning the technique of the trade. At the end of the six months he was able to point out in practical and economical fashion what the goods needed to make them satisfactory to the Argentine and Uruguayan market. Then he arranged for a big order and went back to Buenos Ayres to study the fresh demands of the market there. Since then he has been vibrating between Boston and Buenos Ayres, spending six months annually in each city. He and his partner dominate the trade in their home city and supply practically all dealers in their line of goods in Argentina and Uruguay. The Boston firm finds the arrangement highly profitable.

Few firms have the good luck to pick up so energetic a representative as this, but not a few have of late years gone to a good deal of expense to find and train men who have developed almost as well. By various means they have got into touch with young men, natives of South American countries, and have made it worth their while to come to the United States and work in the shops a year or so. Of course such arrangements have to be very carefully engineered to avoid infringing the provisions of the contract-labor importation law. When these young men have learned the technique of the business they are sent back to their homes to act as salesmen or to operate agencies or branch houses. Knowing the language and customs and being usually well connected socially, they are generally able to make good almost at once. Firms who have tried this method have found that the cost of bringing young fellows to the United States and of paying their wages (which of course is not all loss), is a very cheap investment.

Moreover, it has been found that young Latin Americans, who have spent a year or so in this country, either at work or at college, almost without exception become enthusiastic friends to the United States. When they go back they do a great deal to combat the influence of British and German importers, a very large proportion of whom are engaged in a regular propaganda to injure our trade by disseminating misinformation in regard to our alleged imperial ambitions cherished at the expense of Latin America. At least two attempts are now being made to establish fellowships by which intelligent young Latin Americans can be brought to the United States year after year to get acquainted with us, to learn our methods and thoughts, and to find out for themselves how little we desire to infringe on the rights of their countries. It is expected that every one of these will go back home a confirmed "rooter" for the United States and an able salesman for one or another class of American goods.

For those who cannot afford to train their agents, another method of getting in touch with the right sort of men is recommended by a cash-register house, whose reputation is world wide, and which won its way in Europe by a brilliant advertising campaign that revolutionized methods over there. This firm was marvellously successful in getting native representatives in the smaller countries before it was strong enough to adopt its great wholesale methods. First, it wrote to the United States Consul, asking him to recommend ten or twelve local men whom he thought would be able to handle its business. When the names came—and they always did come—it submitted them to one or two of the big credit-rating agencies and asked for reports on them. These came very quickly and usually enabled the cash register firm to eliminate most of the nominees. Then it wrote directly to the two or three who remained and inquired into their willingness. In the end the firm usually found a man who rendered them good service. He was seldom a man who knew much about cash registers; but he was always energetic, reliable, and well acquainted both with his countrymen and with their habits of thought. Usually he was related to important people, who not only gave him orders, but who helped him to make good with other people.

Nowadays firms that do not care to venture altogether alone into the export field can usually find companions to share expenses with them. These companions may be either firms engaged in non-competitive but cognate industries (as printing-press makers and type founders), or they may be firms engaged in the same identical business. The first class of coöperation has long been practiced, but the second class has been avoided because it was feared that it might fall under the ban of the Sherman law, which forbids coöperation between competitive firms and which has never been declared by the courts to apply only to coöperation in domestic business. An effort to remedy this uncertainty by Act of Congress is found in the Webb law, recently passed.

Many coöperative arrangements between firms have worked very well. Twelve years ago six Philadelphia firms formed such an association that has prospered exceedingly. These firms dealt in non-competing lines of hardware. One made locks, another meat choppers, another saws, another edged tools. Today they would all probably be recognized as "big" manufacturers, but most of them were in the "small" class when they began their export ventures. They maintain agencies in half a dozen countries and send salesmen all over the world. Each pays a share of the expenses proportioned to the amount of business he does through the association.

Another coöperative enterprise of the same general type was organized in Ohio to supply the printing markets in China. Of the six or eight firms that belonged to it, one sells printing presses, another type, another paper, another general printing furniture and fittings, and so on. Each handles a line of printing material that the others do not touch, but all of which are bought by the same people and can readily be sold by one salesman. Most of the foreign customers of the association have probably scarcely realized that they are dealing with half a dozen firms and not with one.

A firm in New York made metal clips, primarily for glove fasteners—and then, for its members were enterprising chaps, for shirtwaists, plaquets, shoes, caps, buckles, and finally for machinery belts. When they got along this far they began to consider venturing into the foreign field.

But they did not know where to begin. The business, though widely scattered, was not a very big one and could not afford expensive methods. But they wanted to go in; they had seen the clips customary on most foreign goods and had found them anathema; and they were convinced that if they could once get their line introduced into a foreign market it would score a big success.

Finally they hit on an idea. They had two or three domestic travelling men and they instructed these to ask every customer, casually, whether he sold goods abroad. The result gave them a good list of export traders in desired lines. Then they went or wrote to each firm and asked on what terms it would let its travelling men or other agents abroad sell the clips as a side line. Some firms, of course, declined, but several consented to do the work on a commission basis. When the plan was tried out, some of the salesmen ignored the whole thing; but some made conscientious and reasonably successful efforts to introduce the line. The attempt involves approach to a list of foreign firms different from those with which the salesmen had been accustomed to deal; and it may or may not succeed. It is as yet too new to make prophecy advisable.

Financial Assistance in Foreign Trade

PRIOR to the outbreak of the European war, all financing of American foreign trade was ultimately transacted through London banks, which, of course, collected their toll for the service. Whether it was a Paterson manufacturer buying silk from Japan or a manufacturer in the Middle West selling tractors to the Far East, the banks of England financed and dominated all world trade because sterling credit was available in all parts of the world. In London no less than 18 discount banks, including four incorporated companies and 14 private firms, with an aggregate capital in excess of $50,000,000, were the instruments of this great financial business, which is estimated to have cost American exporters and importers about $10,000,000 a year.

With the outbreak of the war, imposing new conditions, the London market was compelled to restrict its financial transactions and American financiers grasped the opportunity to free themselves of their dependence on Great Britain. Moreover, their position with reference to London had undergone a radical change in that they had become the lenders of billions to that market instead of its debtors. The acceptance, a form of commercial paper long in use abroad, had recently been made possible in the United States for the accommodation of merchants transacting both foreign and domestic trade through the recommendation of the

(Concluded on page 442)

The Shotgun's Debut as a Military Weapon

ONE war suggestion which has been put through in record time is the shotgun. For experts and soldiers at various times have urged the employment of the repeating shotgun both for our aviators and our infantry, ever since we entered the war; and now General Pershing's men are using a military shotgun.

The new weapon is a comparatively short repeating shotgun of the pump-action type, holding six shells in its magazine. Each shell is of the paper kind such as is used in sporting shotguns, and contains nine pellets of No. 00 buckshot, or about the size of a .32 caliber bullet. When fired the new American gun sprays the contents of each shell over an area measuring nine feet horizontally and about three feet vertically, so that it is almost impossible not to hit a large number of enemy infantrymen coming to the attack in the typical mass formation of the Germans. As for the penetrating power of the buckshot, it is reported that during a recent test the hail of lead went through a two-inch plank with plenty of energy left for further damage, at 150 yards from the muzzle.

One of the problems which had to be solved in adapting the shotgun to military practice was that of the bayonet. The shotgun barrel is quite thin, so much so, in fact, that it would not offer sufficient support for bayonet work. This difficulty was overcome, however, by providing the shotgun with an outer steel coat or jacket which, being perforated and held a short distance away from the barrel proper so as to form an air space, acts as a cooling member while affording rigid support for the bayonet.

The American Army shotgun weighs 8¾ pounds, complete with bayonet. It is equipped from muzzle to stock with a leather rifle sling so that it may be slung over the neck and shoulder.

Courtesy N. Y. Sun

Equipped with a bayonet, the shotgun has now become an American Army weapon

When Guns Go to the Hospital

GUNS are comparatively short lived. So great is the wear and tear on the modern gun of fairly large size that after a few hundred or few thousand rounds, as the case may be, it must be sent to the gun hospital at the rear, there to be refitted for further service.

While it is impossible to give definite figures that would apply to all kinds of guns, it is generally held that a field gun of three-inch bore, such as the French "75" or the German "77," is capable of firing between 5,000 and 6,000 rounds before it requires mechanical attention. But the life of a gun decreases rapidly with the increase of bore; so that in the case of a six-inch gun the life is perhaps 2,500 rounds, while for a 12-inch it is perhaps not greater than 250 rounds. Of the very large guns such as the German 17-inch howitzers used early in the war to reduce Liége and Antwerp, it was said at the time that the life was about twenty-five accurate shots and twenty-five additional but somewhat faulty shots before each gun had to be relined.

Among other things, the recoil mechanism—particularly the springs—of the guns has to be adjusted and renewed occasionally. In the accompanying illustration appears a typical scene in a British gun hospital, showing the mechanics replacing the recoil springs of large field guns.

Copyright, Western Newspaper Union

Scene in a British gun hospital, showing the Tommies repairing the recoil springs of field guns

Gas-Proof Quarters for Military Carrier-Pigeons

ALL animals employed in the war zone must be protected against poisonous gases. In the case of horses and dogs, suitable masks are provided. When it comes to carrier pigeons, however, we learn that the Germans are making use of gas-proof quarters for their winged messengers.

So few photographs have come out of Germany of late that the accompanying one is doubly interesting. It shows a gas-proof container for carrier pigeons being used in a front line trench. The container, it appears, is made of metal and provided with circular openings with lids. Gas filters of a type similar to those used in German gas helmets are provided to neutralize the poisonous elements in the air entering the container.

Copyright, Kadel & Herbert

These German pigeons are protected against poisonous gases while in their special container

The Current Supplement

AN event which is always looked forward to with interest by the scientific world is the annual series of lectures that is delivered each winter by Sir J. J. Thomson, the eminent authority on molecular physics before the Royal Institution, London. This year the subject treated of is *Problems in Atomic Structure*, and a report of the first lecture will be found in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2210, for May 11th. The rest of this series of lectures will appear in successive issues of the SUPPLEMENT. An interesting problem that has hitherto escaped the attention of scientists is what becomes of the heat radiated by the sun. This is discussed in an article entitled *the Ether Ball*, in this issue. Anything relating to food attracts public attention today, so the illustrated article on *The Turtles of the West Indies*, which tells of the varieties found there and their habits, and of experiments in breeding them, will be found acceptable reading. The blockades established against Germany since the war began have greatly reduced its resources in many kinds of materials, and this is particularly the case with the copper, zinc, aluminum, etc., so extensively used in electrical machinery, and many makeshifts have to be resorted to in order to keep this class of apparatus in operation. An article on *Substitutes in the German Electrical Industry* gives an excellent account of what has been done in this direction, and our manufacturers will undoubtedly find many points of economic value in the description. A paper on *The Salvage of U-Boat Victims* discusses a matter that will be of great importance immediately the war is ended when special efforts will undoubtedly be made to recover as many as possible of the hundreds of ships that have been sent to the bottom by the German under-seas pirates. The paper is illustrated by a number of photographs. The paper on *Ferro-Concrete Ships* is concluded in this issue. *Failure in Metals* considers a matter of considerable importance to every branch of metal manufacture. While we have wonderful and instructive collections of the workmanship of ancient times, little or no attention has been given to how it was done. A interesting discussion of this matter will be found in *History in Tools*, which is accompanied by a number of drawings. *The Merchant Ship of the Future* considers problems of the future design and construction of merchant ships. The stimulus given to shipbuilding by the events of the war promises radical results as soon as the subject can be taken up and recently acquired knowledge applied.

Cooking Utensils of Pure Nickel

A RECENT suggestion of cooking utensils of pure nickel bids fair to be a valuable and an important one. This metal has many striking points in its favor. Pure solid nickel should not be confounded with the much inferior metals usually sold as nickel, which consist of steel, brass or German silver with a thin plating of nickel. This plating wears off in a short time, leaving manufactured articles unserviceable and worthless.

Pure nickel, on the other hand, does not rust or oxidize, and consequently every danger of poisoning generally caused by verdigris is eliminated. Neither will the metal tarnish and, even though the surface be injured, there is no danger of corrosion resulting as in a plated article. Furthermore, the tedious and expensive plating operation is entirely abolished. This makes the metal particularly adaptable for use in the manufacture of cooking utensils or food handling equipment where the highest precautions must always be observed to avoid infection and poisoning. The advantage of perfect safety lasts as long as the article itself, whereas plated utensils must be discarded or replated upon the appearance of the slightest break in the nickel protecting surface.

While not so good a heat conductor as aluminum, nickel utensils are made of a thinner material, which more than overcomes the difference. Pure nickel has a melting point of about 2,600 deg. Fahr., whereas aluminum has one of about 1,200 degrees. There is not the same possibility of this metal being softened under constant use. The metal is also much more resistant to the action of the acids commonly found in food products, and is practically immune to alkaline attack. The fine silverlike appearance of pure nickel does not change in use, and the cleaning of these utensils is as easy and simple as possible, hot water or soda being quite sufficient.

Nickel has a high tensile strength in the sheet form, being homogeneous throughout, is ductile and easily formed by spinning or stamping. No special equipment is necessary for manufacturing articles from these sheets, the same tools and metals being employed as with German silver or hard alloys.

The great increase in the cost of copper and its products has brought pure nickel to a point where it can be compared favorably as to initial cost, without counting long life and service.

Process for Obtaining Crystallized Sulfates

A RECENT French patent relates to a method for producing crystallized metallic sulfates by electrolysis, and is characterized by the fact that no diaphragm is employed. Sulfuric acid is employed as the liquid. Dilute acid is employed, between two electrodes made of the metal corresponding to the sulfate which is to be obtained. The two electrodes are mounted at the proper distance apart, with the cathode placed above the anode, in order to provide for the formation of crystals of sulfate of the metal of the electrodes, and these crystals are produced in the liquid itself.

Inventions New and Interesting

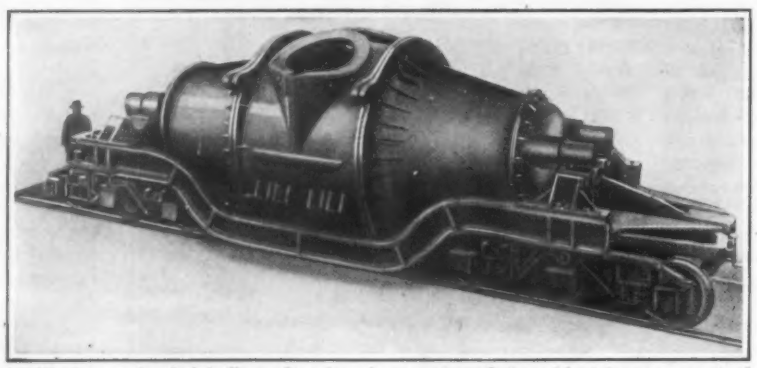
A Department Devoted to Pioneer Work in the Arts

A Novel Car for Transporting Molten Iron

IN some steel plants immense quantities of molten pig iron have to be transferred from the blast furnaces to the steel plant there to be converted directly into steel. This saves the heat necessary to remelt the iron when it is allowed to cool. A new type of car, especially constructed for this purpose, has been perfected. It is noteworthy for its capacity and the fact that it conserves heat and minimizes sculling.

The car illustrated has a capacity of approximately ninety-two tons and it is pointed out that by increasing the length the capacity can be materially augmented without changing the side or overhead clearances. The body of the ladle is made up of flanged steel castings bolted together, which arrangement enables the sections to be separated and the entire lining removed if this should become necessary on account of the charge freezing or for any other reason. The ladle, which is supported and tilted on trunnions in the customary manner, is of circular construction, which gives the maximum strength. The ladle trunnions are supported by two six-wheel trucks, the arch-bars or frames being hinged to enable the three wheels on one side of the truck to bear equal loads. If desired the ladle body can be made of steel plate in place of the castings illustrated.

The capability of carrying a large amount of metal has, of course, the effect of reducing the dead weight of the cars required to transport a given tonnage with a corresponding decrease in the wear and tear on the equipment and cost of repairs. The opening in the top of the ladle is comparatively small in proportion to the capacity and it is explained that this form of construction tends to conserve the heat and insure the delivery of hotter metal. In a number of cases, although several hours elapsed between the time of charging the ladle and emptying it, the fluidity of the charge was found not to be impaired. The ladle is claimed to be entirely self-cleaning, as if it should not be entirely emptied at any time, the succeeding charges of metal will cut out all material left.



In this huge wheeled ladle molten iron is transferred from blast furnace to steel plant without cooling

Lamps Installed Under the Car Seats

THE problem of lighting the aisle of a sleeping car at night after the passengers have retired and the curtains been drawn is one which has concerned the Pullman Company for a long time. The solution was rendered somewhat difficult by reason of the fact that while it was essential to disseminate a satisfactory illumination throughout the length of the aisle it was also equally important that the rays should not penetrate into the berths occupied by sleeping passengers. All the demands seem to have been answered by a system of lamp installation under the seats which is now being made in all new cars turned out by the company and also on the old cars sent in for repairs.

A shield and fixture pressed out of sheet metal is attached to the end of the seat and seat-rail in each alternate compartment so that the lights are staggered on each side of the aisle. Each of these is supplied with a window fitted with a piece of green tinted glass which throws a sufficient amount of light upon the floor of the car without permitting any of the rays to be reflected into the berths. A 12-compartment car has five of these tungsten type, aisle lights of 15 watts and 32 volts.

During the experimental tests which were made of this new idea it was found that it worked out so well that a similar innovation has been planned for illuminating the treads of the steps at stations when passengers are boarding and alighting, and the green glass will be replaced by clear glass.

Successful lighting of a sleeping car

The light under the seat that shines in the aisle but not in the eyes of the sleepers

Operating the Farm Tractor with Coal Gas

THE use of coal gas for operating motor vehicles seems to have gone beyond the experimental stage in England. When the first reports telling of the application of coal gas to automobiles and motor buses reached this country, the matter was generally looked upon as a passing novelty. But since then evidence has continued to accumulate, proving beyond doubt that coal gas is an established motor fuel in wartime England, or at least while the present high price of gasoline obtains.

From the city vehicle the new fuel has made its way to the farm tractor, as is evident from the accompanying illustrations made on a farm near Midlands, England. Here a coal-gas farm tractor is shown in operation and being refilled. It will be noted that the fuel, as in the case of the city vehicles, is carried in a collapsible rubberized-fabric bag supported over the tractor. A spare holder carried on a two-wheeled truck is filled at the nearest gas supply station and is then wheeled to any part of the field where the tractor may be at work, there to serve as a recharging means as shown in the second illustration. It is said that one filling of the gas bag is sufficient to plow half an acre, or at a cost of about ten cents for fuel.

Filing of Patent, Trade Mark and Copyright Applications in Enemy Countries Forbidden

By E. B. Marshall

ALTHOUGH general commercial relations with Germany and Austria were terminated when we declared war, nevertheless, provision was made for the filing and the prosecution of patent, trade mark and copyright applications in the enemy countries by citizens of the United States and also for the payment of fees including annuities which become due to preserve in force German and Austrian patents for their full term.

Under the authority vested with the Federal Trade Commissioners, licenses were granted to forward through neutral countries to Germany and Austria, application papers and amendments and remittance to pay fees and taxes. Up to April 11th, 1918, patent and trade mark applications and amendments were forwarded for filing and fees were remitted, but on that day an order was issued prohibiting the grant of such licenses by the Federal Trade Commissioners.

The filing and the prosecution of German and Austrian patent, trade mark and copyright applications by United States citizens are now prohibited and it is also impossible for United States citizens to pay patent annuities and renewal fees on trade mark registrations in the enemy countries. While property rights of our

(Concluded on page 442)

Copyright, International Film Service

This tractor operating on coal gas plows half an acre on one filling of the bag

Copyright, International Film Service

Reinflating the gas bag of an English farm tractor operating on coal gas

SHIPS, a hundred thousand ships, should enter and leave our ports this year, to carry men, food and munitions to our Allies.

"There is now a Fisk Tire for every motor vehicle that rolls."

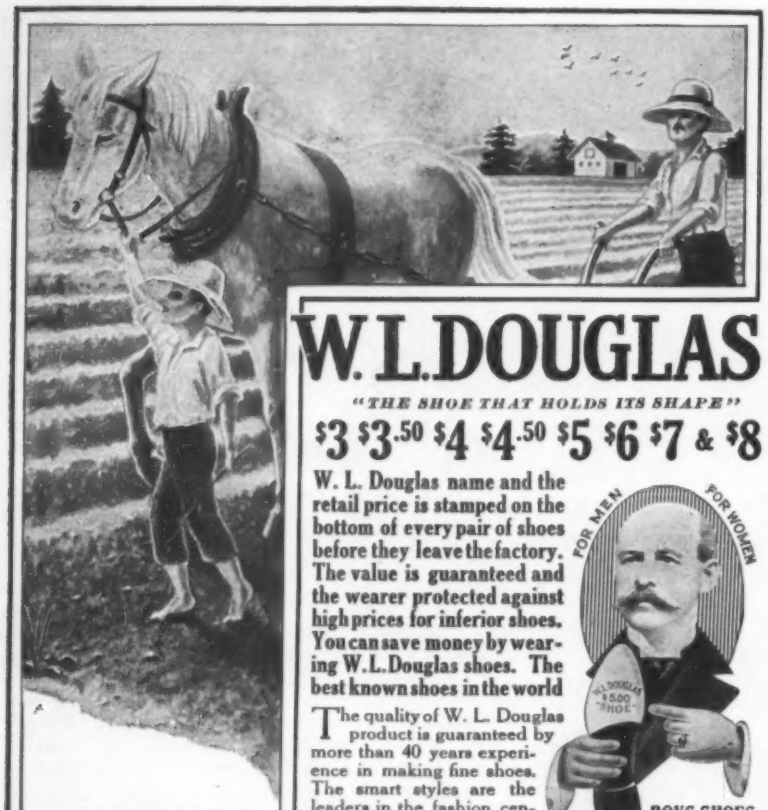
FROM the manufacturer to the trenches the motor truck is constantly playing its part in speeding overseas transportation.

SHIPS depend on Trucks—Trucks depend on Tires. Never has quality meant so much!

BRUTALLY strong—built to withstand the greatest demands made upon them—FISK SOLID TIRES faithfully meet every possible requirement of truck service.

WHEN you need Solid Tires—buy Fisk.

FISK SOLID TIRES



For a brief time W. L. Douglas worked for a farmer for his board and clothes and the privilege of attending school in Winter, practically the only period of his long and busy life that has not been spent in the shoe industry.

Copyright, W. L. Douglas Shoe Co.

W. L. DOUGLAS

"THE SHOE THAT HOLDS ITS SHAPE"

$3 $3.50 $4 $4.50 $5 $6 $7 & $8

W. L. Douglas name and the retail price is stamped on the bottom of every pair of shoes before they leave the factory. The value is guaranteed and the wearer protected against high prices for inferior shoes. You can save money by wearing W. L. Douglas shoes. The best known shoes in the world

BOYS SHOES
Best in the World
$3 $2.50 $2

The quality of W. L. Douglas product is guaranteed by more than 40 years experience in making fine shoes. The smart styles are the leaders in the fashion centres of America. They are made in a well-equipped factory at Brockton, Mass., by the highest paid, skilled shoemakers, under the direction and supervision of experienced men, all working with an honest determination to make the best shoes for the price that money can buy.

The retail prices are the same everywhere. They cost no more in San Francisco than they do in New York. They are always worth the price paid for them.

CAUTION—Before you buy be sure W. L. Douglas name and the retail price is stamped on the bottom and the inside top facing. This is your only protection against high prices for inferior shoes. BEWARE OF FRAUD.

Sold by over 9000 shoe dealers and 105 W. L. Douglas stores. If not convenient to call at W. L. Douglas store, ask your local dealer for them. Take no other make. Write for booklet, showing how to order shoes by mail, postage free.

W. L. Douglas
President
W. L. DOUGLAS SHOE CO.
163 Spark St., Brockton, Mass.

HANDY MAN'S WORKSHOP AND LABORATORY

Compiled and edited by A. Russell Bond. 6x8¼ inches. Cloth. 467 pages. 370 illustrations, $2.00.
A compilation of hundreds of valuable suggestions and ingenious ideas for the mechanic and those mechanically inclined. The suggestions are practical and the solutions to which they refer are of frequent occurrence. It may be regarded as the best collection of ideas of resourceful men published.

MUNN & Co., Inc., Publishers, Woolworth Building, New York City

The Great New American Industry

1915 ■ 215,602
1916 ■■ 520,847
1917 ■■■ 901,223
1918 ■■■

The Seal of Dependable Performance

Trade Mark Reg. U. S. Pat. Off.

ACME
THE TRUCK OF PROVED UNITS

JUDGE TRUCKS BY THE ACME STANDARD

which is another way of saying, judge trucks as you judge men—*by the qualities they possess.* *Acme proved units*—each beyond question the greatest in its field—have made the Acme the Truck by which other trucks are measured.

Here in the Acme truck you find those standards—those engineering perfections like Continental Motor, Timken worm drive, axles and bearings; Borg & Beck clutch—which you yourself would select were you to be asked today to name the units *vital to 100% truck efficiency.*

First place in truck consideration goes to the Acme by right of its proved units.

Ever Ready and Dependable

Acme engineers have built this truck—combined the proved units—to fit all traffic needs. Never is it necessary to adjust traffic to fit the truck. Acme carries all loads within reason over all roads—far beyond its rated power. Here is the true standard of truck dependability—here is the truest measure of service. A mere scanning of the list of Acme proved units reveals supremacy of Acme service—reveals the surprising economies which this truck effects.

HELP WIN THE WAR
Relieve the Railroads
Reduce your delivery costs and end delay with the ACME in your service

"Pointers to Profits"

is the new book we have compiled from the experience records of hundreds of truck users. We are sure this book will interest you and will gladly send you a copy if your request is on your business letterhead.

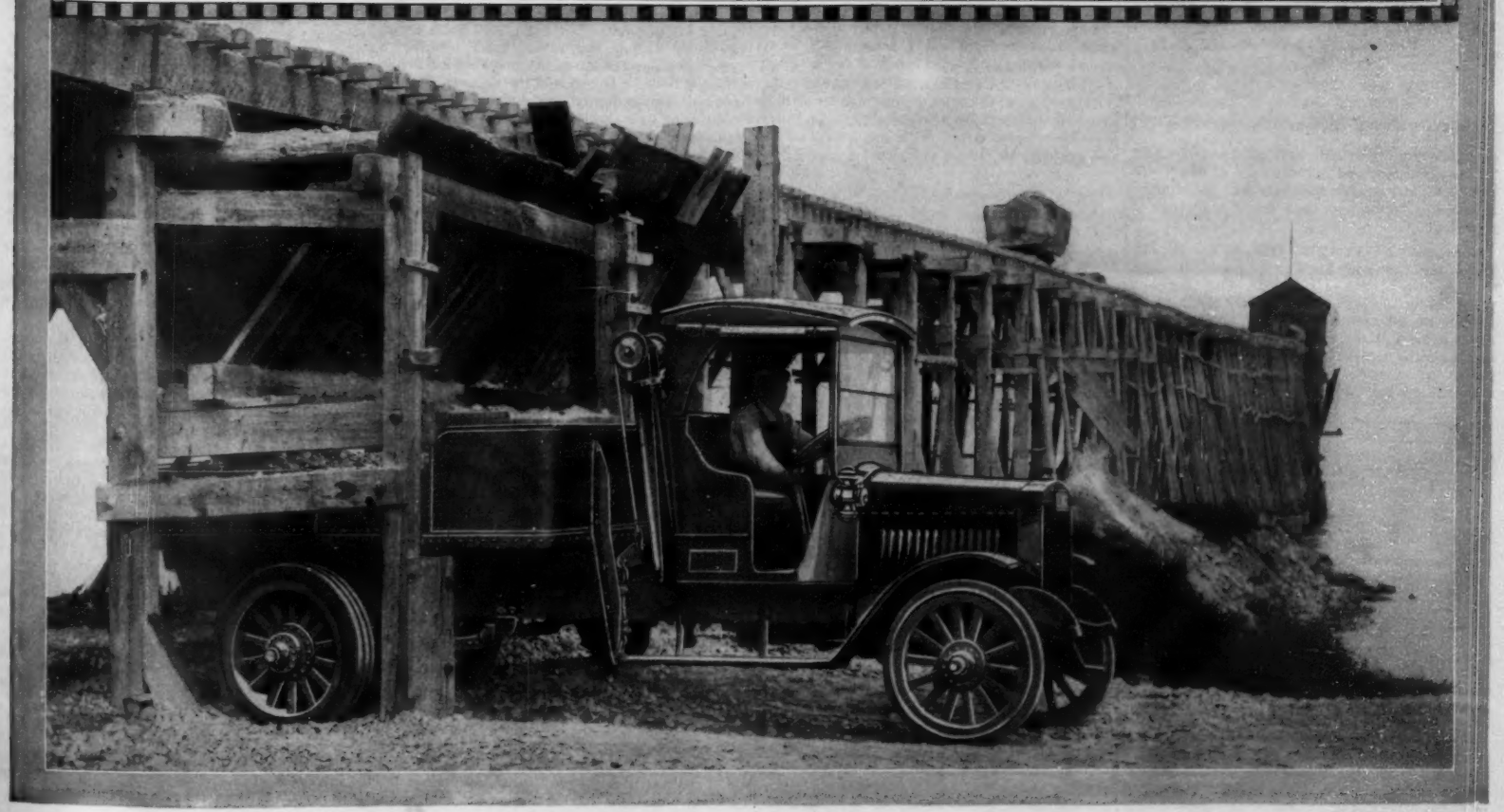
Models: 1 to 4 tons

ACME MOTOR TRUCK CO.

191 Mitchell Street *Cadillac, Michigan*

Proved Units of Acme Construction

Continental Motor
Timken Axles
Timken Bearings
Timken-David Brown Worm Drive
Cotta Transmission
Borg & Beck Clutch
Ross Steering Gear
Blood Bros. Universal Joints
Smith Pressed Steel Frame
Detroit Springs
Hayes Artillery Type Wheels
Eisemann High Tension Magneto
Rayfield Carburetor
Stewart Vacuum Feed
Tubular Type Truck Radiator
Centrifugal Type Governor

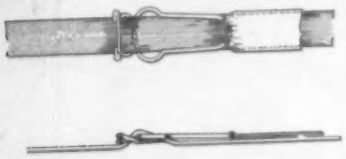


RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

BUCKLE.—H. J. WILTON, 1243 Victoria Drive, Vancouver, B. C., Canada. The invention has for its object to provide a buckle especially adapted for connecting the ends of a belt, the buckle is formed of resilient material, shaped to



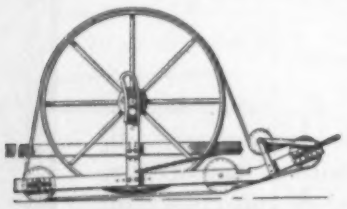
FRONT AND SIDE VIEWS IN ENGAGED POSITION

form an open loop, one end of which is engaged by one end of the belt, the other end of the loop having means for clasping the other end of the belt.

Of Interest to Farmers

BALING PRESS.—C. L. NORTH, 1316 N. Kansas St., El Paso, Texas. The object of this invention is to provide a bailing press especially designed for forming hay, straw, cotton, or like material into compressed, compact bales wherein the pressure is brought about by means of a compound cam movement requiring a minimum of power for a maximum of compression.

TRACTOR ATTACHMENT FOR BINDERS.—J. B. DE WOLF, Box 362, Huron, S. D. The invention relates generally to tractor attachments for binders and various other agricultural implements, particularly those having

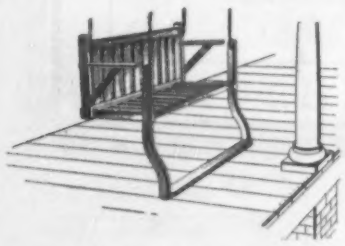


A SIDE ELEVATION SHOWING THE ATTACHMENT CONNECTED WITH MACHINE

power driven tractor wheels, the object being to provide an attachment of a simple and inexpensive nature, attachable to machines of these and other types, in order to increase the area of tractive contact with the surface over which the machine is operated and to prevent slippage or dragging of the tractive wheels when the machine is being used upon soft wet surfaces.

Of General Interest

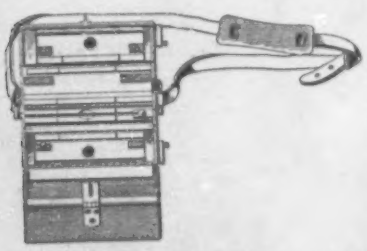
SWING.—J. L. HICKS, Doniphan, Miss. The invention relates particularly to swings which are suspended by means of flexible connections, such as chains, from an overhead support, the object being to provide a swing of this nature, the motion



A PERSPECTIVE VIEW OF THE INVENTION

of which may be readily and quickly controlled by the occupant, and the structure of which will be simple, inexpensive and durable. In addition to the seat frame and back frame a footrest is provided.

MAGAZINE PLATE HOLDER.—E. E. THRASHER, 220 Race St., Cumberland, Md. An object of the invention is to provide a magazine plate holder for handling a photographic plate, so that an unexposed plate may be transferred into a camera plate holder, exposed in the camera and returned to the device without fogging the plate, the operations being capable of performance in daylight, the device is arranged in such

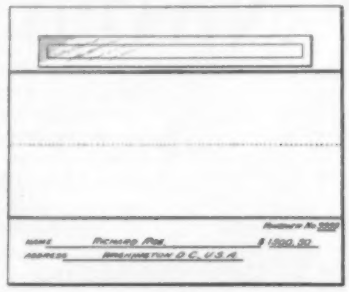


A FRONT ELEVATION OF THE MAGAZINE HOLDER

a manner that the plates are passed through the device from top to bottom in regular order; the device includes a plate storage box for holding a plurality of unexposed plates, the arrangement being such that only a single plate holder is necessary. Another object is to provide a transfer frame by which a single plate is discharged from the magazine at a time.

SCALE.—S. FARREIRA, Pay Officer's Office, U. S. Naval Station, Pearl Harbor, Hawaii. The invention relates particularly to an arrangement whereby the scales wil automatically show the correct weight of anything placed on the platform, an object is to provide an arrangement for quickly and accurately adjusting the weight on the scale beam to cause the same to balance properly. A further object is to provide a scale beam with a traveling motor arrangement together with a switching mechanism operated by the beam and a suitable electric circuit whereby current is turned on to the motor for driving the same in either direction according to the position of the scale beam.

VOUCHER CHECK.—A. G. ANDERSON, P. O. Box 23, Seward, Alaska. The prime object of the invention is to provide a voucher check that will result in a material saving of time by necessitating the writing of the payee's name but once only. This object is attained by an instrument foldable on itself on an approximately median line,



REAR VIEW OF VOUCHER CHECK SHOWING SAME UNFOLDED

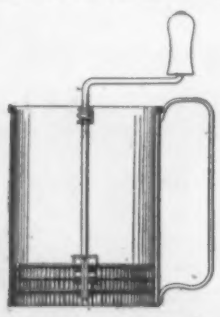
that portion at one side of the median line constituting a check, and the portion at the opposite side of the median line pertaining to a voucher, one of said portions having a window therein and the other having a space thereon for the name of the payee so located that the name will appear at and be readable through the window when the instrument is folded on itself.

APPARATUS FOR PROTECTING SHIPS AGAINST TORPEDO ATTACKS.—J. L. ALEMANY, P. O. Box 152 San German, Porto Rico. Among the principal objects which the invention has in view are, to avoid retarding the headway of a ship when provided with this apparatus, to dispose the device rapidly in service relation, to accommodate the docking facilities afforded ships in harbors and to manufacture the apparatus at a reasonable cost. The device provides for a false bow, and fender plates of thin metal sufficiently flexible to fold against the sides of the ship when necessary, means for suspending the plates by a series of booms adjustably extending from the sides of the ship.

SCAFFOLD.—N. ARESON, 1044 Congress St., Portland, Ore. The invention relates particularly to a scaffold support comprising hangers provided at their upper ends with adjustable bracket arms to hook over a beam. The prime object is to provide a structure in which the adjustment of the upper and lower bracket arms relatively to the hangers may be quickly and conveniently effected and in which the several bracket arms will be firmly held in the adjusted position.

HYDROPNEUMATIC PUMP.—B. S. HARRIS, Greenville, S. C. The invention relates more particularly to a pump in the nature of a compressed air water elevator, without pistons, and capable of use without undue wear even in localities where sand is frequently carried with the fluid to be pumped, the prime object is to provide a pump which will be simple, strong and durable which will permit of ready accessibility to its several working parts, for repair or substitution.

SIFTER.—J. E. TRICE, 4th Floor, Barries Bldg., Wichita, Kans. The invention relates to flour sifters, the object is to provide a simple and inexpensive sectional sifter, with removable screens and stirrers, the device comprises a plurality of



LONGITUDINAL SECTION OF SIFTER WITH THE INVENTION

super-imposing screens with rings of corrugated material supporting them at the margin in spaced super-imposing relation, a stirrer on each screen, and means for actuating the stirrer.

WATER-LEVEL REGULATING DEVICE.—A. H. SIMMONS, Box 197, Swift Current, Sask., Canada. The object of the invention is to provide mechanism of the character specified used in water troughs, which will be automatically operated to admit the water from the source of supply when the water falls below a predetermined level and will always retain the water at a certain level in the trough.

PUMP.—S. V. PERRY, Box 120, Ranger, Texas. One of the main objects of the invention is to provide means whereby a pump barrel may be readily disengaged from its normal engagement with the well tube for removal for repairs or any other reasons by upward strain on the operating cable, rod, or equivalent, thereby overcoming the necessity for rotating the barrel, as in the patent granted the same inventor March 30th, 1909.

Hardware and Tools

VALVE.—D. BROWN, 3d and Y Sts., San Bernardino, Cal. This invention is adapted to be embodied in various valves comprising a valve body, a stem, and a valve adapted to be seated or unseated by the turning of the stem in the body. More particularly the invention relates to a self-packing valve, and its object is to provide a valve whereby to prevent leakage around the valve stem without special packing and at the same time insure a positive operation of the valve in response to the turning of the stem.

ARMOR.—J. ELLIOTT, 912 19th St., N. W., Washington, D. C. The object of the invention is to dissipate the destructive power of an explosive against the side of a vessel to a degree that will prevent extensive rupture. The armor plate provided by the invention consists of diagonally arranged interlaced strips of low melting point alloy having metal reinforcements in the strips, the strips also being provided with chambers containing explosive material.

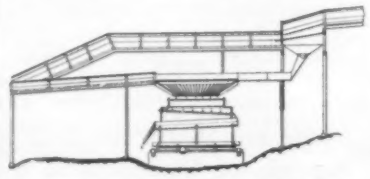
NUT LOCK.—G. W. WATTS, 423 Main St., Cincinnati, Ohio. The invention relates to nut locks of the type in which a set screw is threaded through the nut for engagement with the threads of the bolt to lock the nut in connection with the bolt. On a bolt having a threaded portion is located a nut having a threaded opening in one side that receives a set-screw, whose polygonal head is engaged by extensions of a locking plate whereby the rotation of the set-screw is prevented.

Household Utilities

WARDROBE.—F. N. BARDWELL, 98 Howell Ave., Passaic, N. J. This invention relates to portable wardrobes, a specific object is the provision of a wardrobe composed of a plurality of hingedly connected sections of which one at least is a compartment for holding wearing apparel and the other sections compartments or panels which may be set at any desired angle, so that the wardrobe has the appearance of a screen rather than a cabinet for holding articles.

Machines and Mechanical Devices

AMALGAMATOR.—J. I. LEFORS, address Richards and Haga, Lawyers, Boise, Idaho. The invention relates generally to machines for the handling of placer gravel and saving the fine gold contained therein, but more particularly to



SIDE ELEVATION OF COMPLETE DEVICE

an amalgamating apparatus acting upon the gold contained material in successive operations, the object is to provide an apparatus which will actually save the fine gold, and also concentrate any other metal or mineral contained in the black sand or content in alluvial or placer mining ground.

CLUTCH.—E. WILLIAMS, Edgbaston, Birmingham, England. This invention has for its object the construction of a clutch applicable for a variety of purposes but adapted more especially for use in machine tools such as lathes, milling machines and the like. The invention comprises an inner conical sliding member and a complimentary outer member, of bell crank levers connected at one end to the inner member, a plate on which the levers are mounted by pivots situated between the ends of the levers, a stepped collar slidably mounted on the shaft, the arrangement being such that by an axial movement of the collar the levers are actuated for disengaging the clutch members or permitting them to engage under the action of springs.

DUBBING MACHINE.—J. W. INGLETON, Box 964, Astoria, Ore. The invention is intended to be embodied in a machine for use in building wooden ships to dub off or plane the ribs of the ship on the outer side to receive the planking and on the inner side for the ceiling. The objects are to provide a machine having a power-driven cutter head and side runners to sustain and guide the machine and adjustable to regulate the depth of the cut, to provide for the ready lateral adjustment of frame parts carrying the runners whereby to vary the distance between the runners.

PUNCHING PRESS.—M. F. CARR, 225 Adelphi St., Brooklyn, N. Y. This invention relates to punching presses particularly designed for punching ship plates. Among the objects is to provide a simple, strong and efficient press whereby standard punching can be done, or in which any departure from the standard punching can be easily and quickly accomplished.

CONCRETE MIXER.—H. D. WEGE, Barre, Wis. The object of the invention is to provide a device wherein a rotatable casing is provided having at one end a discharge opening, and a mixing vane on the inner face of the end, so arranged that when the casing is rotated in one direction the vane will prevent the material passing out, while when turned in the other direction will cause the material to discharge, and wherein the mixing is brought about solely by the rotation of the casing and the action of the vane.

FLUID VENDING MACHINE.—J. McG. CHANDLER, Grossbeck, Texas. The object of the invention is to provide an automatic fluid vending machine having means for shutting off the supply of fluid when fluid to the value of the coin introduced into the machine has been dispensed. The said means is adjustable, and provision is made for an indicator disposed at a distance from the machine which will indicate when the supply of fluid has been entirely sold, the coin chute can then be closed.

Prime Movers and Their Accessories

ROTARY MOTOR.—J. MONSON, 201 E. 30th St., New York, N. Y. The object of the invention is to provide a rotary motor which is simple in construction, and especially designed for using steam as a motive agent. In order to accomplish this result use is made of a pressure chamber connected with a suitable source of steam supply such as a boiler, and a wheel mounted to rotate freely in the said chamber, the said wheel being provided with a passage having engaging obstacles adjacent to the peripheral face of the wheel, such passage having an entrance opening leading into the pressure chamber and the passage terminating at its end in an exhaust.

FLOAT FEED DEVICE.—M. E. KUEBLER, 128 Ridgewood Ave., Yonkers, N. Y. This invention relates to float feeding devices and has particular reference to structural details relating to the operation of carbureters or the like. Among the objects is to provide a carbureter having facilities for controlling the feed of fuel oil thereto, to provide a new form of float element cooperating with said means for regulating the feed.

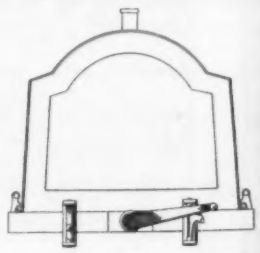
Railways and Their Accessories

STREET AND STATION INDICATOR.—F. B. Robinson, Fort Winfield Scott, Cal. The object of the invention is to provide a device by means of which the names of streets may be indicated to the passengers in a street car, railway train, or the like before such street is reached. A further object is to provide an electrically controlled machine in which the movements of the display device is controlled by means of a pneumatically operated mechanism.

Pertaining to Vehicles

SPRING WHEEL.—R. KRAUSE, 307 Nelson St., Portsmouth, Va. The object of this invention is to provide a wheel especially adapted for use with motor vehicles, wherein the cushioning mechanism is arranged between the hub and the rim, this cushioning mechanism comprises a coiled spring which is connected at one end to the hub, and at the other end to the inner ring, the spring having angular lugs at its ends for engaging openings in the hub and ring to securely connect the ends, the spring is spaced apart by means of rollers.

SAFETY CRANK CATCH FOR AUTOMOBILES.—M. S. LANIER, care of Rome Supply Co., 325 Broad St., Rome, Ga. The invention relates particularly to attachments for automobiles employing cranks at the forward end of the power shaft, the object is to provide a catch which will engage the crank in case of backfire and to obviate injury. A further object is



FRONT ELEVATION SHOWING THE DEVICE

to provide a catch which may be readily positioned at both sides of the starting crank and mounted in connection with the vehicle frame, the catch has a laterally yielding movement to permit the passage of the starting crank, the movement is such that the catch is immediately brought back to operative position by a controlling spring.

VEHICLE-WHEEL TIRE FILLER.—E. T. REYNOLDS, 516 Essex St., Brooklyn, N. Y. Among the principal objects which the invention has in view are, to obtain pneumatic resiliency without abnormal compression of air within the tire, to localize the cushioning effect of the tire, to that point bearing the weight of the vehicle for maintaining a normal supply of air to the filler, and to utilize the combined resiliency of the material from which the filler is constructed and air with which it is supplied.

AUXILIARY AIR VALVE.—B. G. RICH, Colville, Wash. The invention relates to the air valve of internal combustion engines of automobiles and more particularly relates to an auxiliary air valve adapted to be applied to the intake manifold for governing the inlet of air to the fuel mixture before entering the cylinder, to regulate the character of the mixture under given conditions requiring the richness of the mixture to be varied. An important object of the invention is to provide for automatic valve control through the medium of a pendulous device.

Designs

DESIGN FOR A PICTURE FRAME.—W. ERICKSEN, 235 61st St., Brooklyn, N. Y. This ornamental design shows a picture frame, the top of which is surmounted by a wreath, a helmet, and a rifle, the sides are worked out in Roman design and at the base is shown the tri-colors of France, the shield of America, and the Union Jack of England.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The San Diego Aviator Factory

(*Concluded from page 438*)

this time, but which may stand repeating here. This is merely the cold-blooded one that the tractor, when it falls, doesn't calmly drop the 600- pound engine on the poor pilot. When the tractor gets out of control and goes bump on the hard ground it merely stands on its head and turns a neat somersault, throwing the pilot clear as a rule. The pusher, with engine behind, does its best, under the same conditions, to deposit the heavy engine on the frame of the pilot—and usually succeeds. The result is that the Government is saved hospital bills, but after a while becomes shy of aviators.

The officers of the San Diego school cold-bloodedly figure on falls and plenty of them—and the falls come off as per figure. Between August 1st and the middle of September, according to one undenied report, 39 machines came to grief. This does not mean complete wrecks—most of the damage came from little errors on the part of the students as to location of the ground and speed of the descending ship. The damage was therefore, in many cases, merely smashed wheels and running gear, propellers broken, wings and rudders put out of commission. At the same time there are plenty of falls—the results of which are minimized by the strong construction of the planes and by their tendency to right themselves and fall softly if fall they must. There is never the plunging, rocket-stick sort of earthward progress, imaged by the layman; the fall is always a spiral flutter that does not at any time get up much speed. The Curtiss plane has one wing tip slightly curved to resist the tendency of the engine to drive it sideways, in a fall, and it is as nearly inherently stable as a plane can be without special stabilizing apparatus.

Grief in such cases comes to the student merely from lack of experience, doing the wrong thing that no amount of instruction can guard aginst, any more than it can prevent the tyro automobile driver from pulling the equivalent fool stunts when he gets out alone in his car. Trying to climb at too steep an angle, banking too sharply and other little tricks that make the plane lose headway and slide down the air are responsible for the actual falls that take place. Engine trouble is rarely back of falls, merely because the student is never in such a position that he cannot reach home with the engine entirely dead. Also he is taught early in the game that regardless of where he happens to be in the air or how tempting the target in actual fighting—if the pampered and tempermental beast under the hood shows the first sign of trouble, it is up to him to point the nose of that ship for home and get there pronto. One miss, one cough, one little spit of blue smoke in the wrong place, very likely means a motor that is getting ready to lie down on its back and quit its job—and said quitting may happen in the next 30 seconds.

Because of the delightful reliability of the gas motor in the airplane and because the army gentlemen don't care to see some student having to make a forced landing in the chimney pots of Citizen Spriggins over in San Diego, there is a strict rule that regardless of the position of the plane of the learner, the old reliable ratio of eight to one must be kept. That is, the plane, being able to make eight feet of forward progress to one of drop with the engine dead, must always be such height that this ratio of progress will carry it o its home field. If the pilot flies 8,000 feet from the field, he must be at least 1,000 feet high, if he flies—to reverse the case—5,000 feet high, he can go 40,000 feet or some eight miles from the field. This is of course not adhered to in the case of the more advanced students, men who make cross-country flights to the nearby towns and finally to the beach town of Venice, near Los Angeles and 120 miles from the aviation school.

The students for the school are taken from the ranks of the officers of the regular army, and from the school of military aeronautics at the University of California in Berkeley. Here the student gets the principles of the airplane and of the gas engine and learns shop practice, but gets no actual flying. At North Island the student goes aloft with one of the many competent instructors for his preliminary flights. He follows the moves of the instructor through the duplicate control, but during the first few flights makes no volunteer moves. Then the instructor removes his hands from the wheel and his feet from the foot controls at intervals and lets the student handle the machine, correcting errors as they are made, until finally the student guides the machine alone.

Regular traffic rules govern the scores of planes that roar above the fields at the school. Traffic over a given field must move in the one direction. The man leaving the ground must not start with a machine coming down and so possibly get in the way of or bother the descending pilot.

One of the strict rules of the school is that no student or instructor, regardless of his proficiency, shall perform any stunts within view of the student fliers. While there are a dozen men at the school in the capacity of instructors and lecturers who can neatly perform all the gymnastics peculiar to the finished fighting aviator, they can't perform them in the sight of the students, lest some of the young and therefore ambitious chaps seek to do likewise because of the apparent ease of the stunt. The work of the most finished student ready to graduate is confined to long cross-country flights, to circling certain pylons with neatness and accuracy, and to cutting his engine and landing in a given spot. Also there is the matter of hurdling an obstacle such as a wood might be, and then making the landing at a new spot beyond.

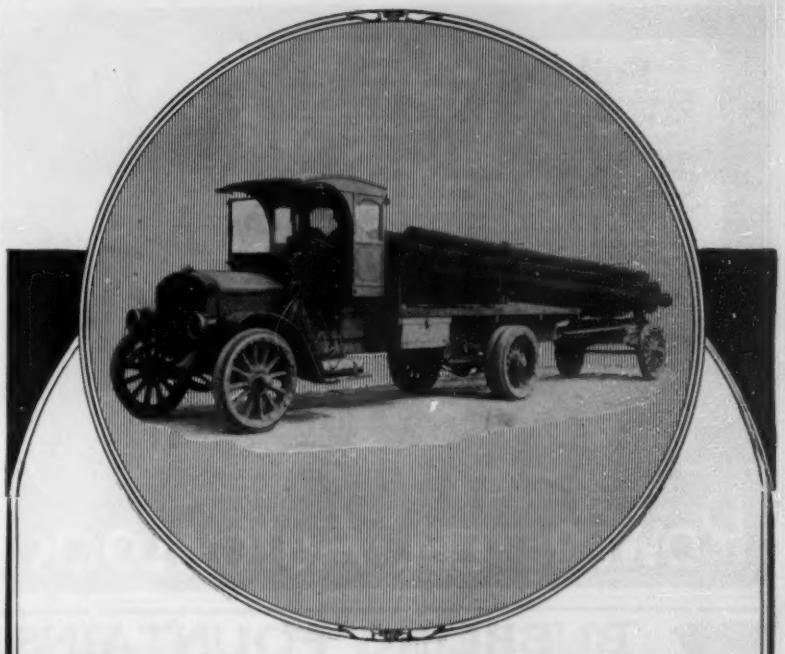
The learner, losing headway and starting to fall, finds the most difficult task he's called on to perform is the correct solution of the "fix" he's gotten into. This is merely to turn her nose down and let her drop until she gets up sufficient speed to allow the nose to be turned up again and still keep the acquired headway. The beginner instead leans back, very horrified, and hauls up her head, which assists still more in losing headway and guaranteeing that the ship fall.

The school boasts two finished French fighting aviators, sent over to us as instructors, Lieutenants Henri Marguisen and Robert Mairesse, both "ace men" of the French aviation corps and both of them men who have won the highest respect and liking of the Yankee flying men associated with them. In spite of their ferocious reputation and their skill they are tall, rosy cheeked, boyish-looking chaps, having all the war-hardened air of the average freshman of the inland college. They fly but little, and are used more to lecture to the students and to give the benefit of their advice generally.

The North Island school is at present under the command of Col. Alexander Dade, whose interest before his present command had been in the flying one does on the hurricane deck of a cavalry horse. Maj. Thurman Bane is the secretary of the school. The aeronautical assignment nearly completes the major's experience in the various branches of the army, as he has served in turn in the engineers, the artillery, the cavalry and the ordnance department, avoiding only the down-trodden infantry.

The instructors and some of the officers at the school wear the new insignia of the flying corps, the silver shield on the breast with the silver wings. The junior aviator wears the shield and one wing, the finished product wears both wings and so the symmetrical decoration.

Youth, and therefore reckless abandon and courage mark the men at the school. The young, restless, unsettled, dashing type of officer predominates. The man over thirty-five is better at some other task. The job demands youth, quickness of reaction, the absence of the cold blooded consideration of the chances that must be taken—the carping one might say the absence of the good, if prudent, sense that marks the man over his reckless and carefree days.



How Warner Trailers Speed Deliveries and Cut Hauling Costs

No. 1—Hauling Oil Casing and Other Lengthy Loads

IN THE oil fields of Oklahoma, the transportation of materials and supplies has always been a serious problem. The loads are difficult to handle — well casings, derricks, rigging timbers, line pipe, etc. Even under the most favorable conditions, loads such as these puzzle transportation experts.

Speed is absolutely essential. Equipment must be hurried to a newly "brought-in" well. Otherwise there is a loss of thousands of barrels of crude oil which cuts deep into the profit column.

Transportation engineers studied these questions for years. Many plans were tried—and discarded because they did not fill requirements.

Motor trucks were employed. Used alone, they were inefficient. They furnished speedy transportation, but they could not carry the lengthy loads. Now, the use of Warner Trailers has solved these problems. They are designed to handle just such loads. They operate perfectly at any motor speed and follow the trucks perfectly around corners, up-hill or down, under all hauling conditions.

Many Uses

Warner Heavy Duty Truck Trailers are made in both two and four wheel types. There is a model to meet hauling requirements in every industry.

An Exclusive Warner Feature

Our universal Ball and Socket Hitch. No coupling pins. Operates like your shoulder joint. Allows for every conceivable position of the truck and trailer. Eliminates all binding strain in going over bumps, around corners and when truck is going up hill and trailer coming down even at extreme angle.

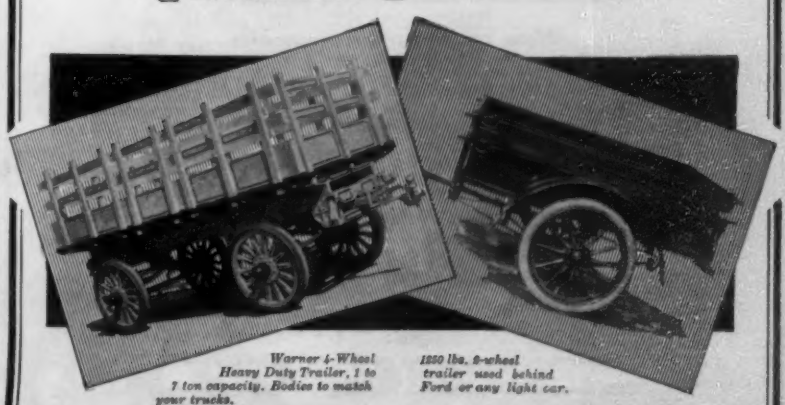
America's largest manufacturers have adopted Warner Trailers upon the advice of their expert transportation engineers. They speed deliveries and cut hauling costs.

Have you made a survey of your hauling problems and the ways in which you meet them? Often efficiency methods, employed elsewhere in a plant, are not carried to the delivery system. We are prepared to aid in such a survey. Write to us today for further data.

WARNER MANUFACTURING CO. 124 Bushnell Avenue BELOIT, WISCONSIN

Inter-City Freight in the future will be largely handled by Motor.
Warner Trailers make possible the truck trains necessary to such service.

WARNER
HEAVY DUTY
TRUCK TRAILERS
TWO AND FOUR WHEEL TYPES



Warner 4-Wheel Heavy Duty Trailer, 1 to 7 ton capacity. Bodies to match your trucks.

1250 lbs. 2-wheel trailer used behind Ford or any light car.

60

Foil the Car Thief

It's always risky to leave a car and spare tires unguarded. The sensible protection is a POWERSTEEL AUTOWLOCK. The weather-proofed Yellow Strand Wire Rope can't easily be cut—the sturdy spring lock is unpickable. Some companies reduce theft insurance 10% where AUTOWLOCKS are used. At dealers, $2.25 east of the Rockies.

BASLINE AUTOWLINE, also of Yellow Strand Rope, is strong and reliable. Patented snaffle hooks attach instantly, safely. At dealers, $4.95 east of the Rockies.

POWERSTEEL TRUCKLINE is just what you need for your heavy-duty power-wagon. Superstrong—it stands the strain. Write for literature.

BRODERICK & BASCOM ROPE CO., ST. LOUIS-NEW YORK
Manufacturers of celebrated Yellow Strand Wire Rope

POWERSTEEL AUTOWLOCK

BUBBLING FOUNTAINS
FOR ATTACHMENT TO MUNICIPAL SUPPLY

Fig. 604

ICE COOLED

Unequalled Keith Bubbler Unless otherwise specified.

This cut shows our No. 604—75 lbs. of ice—cork insulation—15 1-2 coils of 1-2 in. brass tubing No. 22 Gage. Thorough workmanship—selected materials—Tested and adopted by those whose judgment is unquestioned.

Many *types* and sizes. May have coil on bottom as well as on sides. Tasty—convenient—and *efficient*. Very attractive appearance.

Olive brown baked enamel finish—Pure white vitreous cast iron enameled bowl. Fittings—nickel-plated. Wastes above or below the floor.

Send for list of users *Many thousand in use*

Send for catalogue

The Best is the Cheapest

Our lines include: Sanitary Wash Bowls (in Batteries), Bubbling Fountains (plain and ice cooled), Metal Lockers, Metal Stock and Pattern Storage Racks, Metal Shelving, Metal Cabinets, Vault Fixtures, Soda Kettles (40 and 60 gallons), Metal Stools and Chairs, Water Mixers, Work Benches, Bench Legs, Full line of Plumbing Fixtures, etc.

MEECO
Metal Equipment For Shop And Factory

Works and mail address Framingham, Mass.

Manufacturing Equipment and Engineering Co. 156 Federal Street Boston, Mass.

Rockwood friction-- Transmission

Will do more to eliminate the waste of power in machinery involving power transmission than any other mechanical device. This is especially true where quick starts and sudden stops are necessary. Some place in your plant or product there may be a place where Rockwood Friction Transmission will save you time and money. Investigate it. Send for our 92 page book "Friction Transmission." It is of great value to manufacturers, designers, and engineers. Please mention firm connection.

THE ROCKWOOD MFG. CO.
1904 English Ave. Indianapolis, Ind.

ECONOMY
renewable
FUSES

Replace the Link—Renew the Fuse

cut annual fuse maintenance costs 80%. Can be used over and over. An inexpensive "Drop Out" Renewal Link restores a blown Economy Fuse to its original efficiency.

ECONOMY FUSE & MFG. CO.
Kinzie & Orleans Sts., CHICAGO, U.S.A.
Sole Manufacturers of "ARKLESS" the Non-Renewable Fuse with the 100% Guaranteed Indicator.
Also made in Canada at Montreal

INVENTORS' ATTENTION!

Three Rivers Machine, Tool & Die Corp., successors to the Oswego Machine, Tool & Die Works, wishes to announce that they are equipped with finest machinery and employ best tool and model makers in the country to take care of developing and building models for inventors. Will quote on work at reasonable flat hour basis or contract. If interested, write us for particulars.

Three Rivers Machine Tool & Die Corp., Phoenix, N.Y.
Successors to
Oswego Machine Tool & Die Works

Shoot Without Noise

IMPROVE your aim, raise your score of hits, do away with wincing, and get more sport out of shooting than you've had in many a day. Completely swallows the nerve-racking report. Allows women, children, the whole family, to shoot. It's simple; a

MAXIM SILENCER
ON YOUR GUN DOES THE TRICK

At your dealer's. Makes a fine gift for the shooter. Book of queer Maxim Silencer experiences free. The Maxim Silencer Co., 94 Homestead Ave., Hartford, Conn

BOOK FREE

Two New Automobile Books

By VICTOR W. PAGÉ, M.E.
Member of Society Automobile Engineers

How to Run an Automobile

This treatise gives concise instructions for starting and running all makes of gasoline automobiles, how to care for them, and gives distinctive features of control. Describes every step for shifting gears, controlling engines, etc. Thoroughly illustrated. Price $1.00

Storage Batteries Simplified

A comprehensive treatise devoted to secondary batteries, their maintenance, repair and use

This is the most up-to-date book on this subject. Describes fully the Exide, Edison, Gould, Willard, U. S. L. and other storage battery forms in the types best suited for automobile, stationary and marine work. Nothing of importance has been omitted that the reader should know about the practical operation and care of storage batteries. No details have been slighted. The instructions for charging and care have been made as simple as possible. 250 Pages. Very Fully Illustrated. Price $1.50

Books sent prepaid to any address on receipt of price

MUNN & CO., Inc., Woolworth Building, 233 Broadway, New York

The Attack on Zeebrugge and Ostend

(*Concluded from page 433*)

works were shot away, and the ship remained so far intact that she was able to withdraw with the wounded and survivors.

The attack on the mole seems to have been a complete success. One of the submarines made its way to the inshore end, and after being placed below the bridge, the explosives were touched off and the bridge with the German troops gathered upon it was blown up. Meanwhile, the other submarine seems to have blown in the seaward gate leading to the docks of the Bruges canal—one eye-witness stating that, as he left, the water was pouring out through the gates and the vessels inside were straining heavily at their moorings. This, however, has not been verified in the brief Admiralty report. The three cruisers seem to have been sunk in position, blocking the channel.

As to Ostend, the results do not seem to have been so satisfactory, although both of the concreted ships were sunk, and it is believed that the entrance channel is partly blocked. The crews from the concreted ships and the submarines were picked up by fast motor-boats and carried safely back to the main fleet.

Taken as a whole, this exploit is worthy to rank with the best cutting-out expeditions recorded in naval history. It was well conceived, and seems to have been carried out with great dash and coolness. Of course, the element of surprise was there—at least to a partial extent—and it is questionable whether other expeditions of this character will give equally favorable results; since the Germans, from now on, will presumably be at watch for further attacks. If the channels are blocked, and particularly if, as one account states, one or two dredges were sunk, it will be many days and possibly weeks before the submarines and destroyers which were sheltering in the basins and within the canal, will be available for service.

Financial Assistance in Foreign Trade

(*Concluded from page 434*)

Federal Reserve Board. Comparatively little was known of the trade acceptance in this country before the war, but during the last two or three years its importance and value in international business relations have become widely recognized, and it is now one of the most popular and helpful financial instruments.

In this connection, therefore, announcement had recently been made of the incorporation in New York City of a discount bank, the pioneer of its kind in America, with a capital of $2,000,000 and a surplus of $200,000. At least one other discount company is already being discussed for New York City, and still others may come into existence in the near future. It would seem desirable that more should be established to give American exporters and importers all the facilities they have enjoyed in London. The new institution, which has now nearly completed the first month of its operation, deals in both bank and trade acceptances, and will operate as similar institutions have been conducted for years in England and France.

The trade acceptance, as defined by the Federal Reserve Board, is "a bill of exchange drawn by the seller on the purchaser of goods sold and accepted by such purchaser." The Board defines the bank acceptance as "a bill of exchange of which the acceptor is a bank or trust company, or a firm, person, company or corporation engaged in the business of granting bankers' acceptance credits." Thus, in other words, the bank permits the customer to use its credit, which may be secured or not, according to the business and the financial responsibility of the customer.

The trade acceptance enables the seller to conduct his business at a reduced expense and so to sell at lower prices without loss to himself. It is better than an open account system because it sets a definite time limit to the credit, as contrasted with the slowness and uncertainty of the other method. Finally, it constitutes an acknowledgment of the receipt of the goods and is thus a proof of the validity of the debt. Trade acceptances greatly increase the borrowing capacity of "accounts receivable" because they are negotiable instruments carrying two names—those of the seller and the buyer. As the acceptor has planned to pay them out of his fixed income, they are practically self-liquidating.

Bank acceptances enable a merchant to make his purchases advantageously, even in markets where he is unknown. A letter of credit from his bank to the effect that, under certain conditions and up to a certain amount previously agreed upon, all bills drawn to his account will be accepted enhances the merchant's credit without embarrassment to the bank.

The president of the new bank recently defined the scope of its operations by saying that it would not accept deposits like banks nor transact a general banking business, nor would it in any way compete with the established banking institutions. The bank would, he said, not only offer discount facilities to banks as the Federal Reserve System does, but would go even a step further by extending service to firms and individuals also.

The ambition of the United States to retain the foreign trade built up during the past four years depends largely for its accomplishment on the degree to which its credit resources are made mobile and efficient. This can be done best by the establishment of a broad discount market which calls for the general use of the most liquid form of credit instruments and the consensus of the world's financial experience has certified that these are bank and trade acceptances. This, with the endorsement of the financial machinery of our government, should make their adoption universal with us.

Filing in Enemy Countries of Patents, Trade Marks and Copyrights Forbidden

(*Concluded from page 436*)

citizens of German and Austrian patents, trade marks and copyrights may become impaired, there is undoubtedly sufficient information in the possession of the Government to warrant the step which has been taken. It should be understood by our citizens who are owners of patents and trade marks in the enemy countries that there has always been grave danger that under the provisions permitting correspondence with and the transmission of patent and trade mark papers to the enemy, information of great value to the enemy might be forwarded.

When an ordinary letter is censored, it is possible for the censor to delete any portion which he might question, but to delete any portion of a patent specification would hardly be possible without materially changing the disclosure or the subject matter on which the patent is desired. It is also understood that serial numbers of alleged cases might be used to convey messages in code.

It is quite likely that provision will be made in the peace treaties to revive any patent or trade mark rights which may be lost because of the war.

Subjects of the enemy countries are still permitted to file and prosecute patent, trade mark and copyright applications in the United States.

Trade-Mark Piracy

THE wholesale manner in which attempts are being made to steal trade marks in the foreign countries indicates that the present activities are not confined to the trade pirates who have in the past engaged in this nefarious business. American manufacturers and exporters have had little competition in the foreign markets during the war, but this situation will disappear shortly after the termination of hostilities. Some of the foreign countries are already searching with greedy eyes for markets in which to dump merchandise in payment for raw materials which will be necessary during the period of reconstruction. Many reports indicate that the trade pirates are working in the interests of German firms who expect to carry on a large foreign trade when peace is declared.

That Foster Friction Plug Prevents Slipping

It is one of the distinctive features which have led millions of people who desire sure-footedness and safety to choose

CAT'S PAW
CUSHION RUBBER HEELS

in preference to heels that let you slip. Then Cat's Paw Heels are so comfortable. They give you a buoyant, elastic stride that makes walking a genuine pleasure.

No holes to track mud or dirt. No marring of your polished floors. Important features which make it desirable to equip the family shoes with Cat's Paws. They wear longer than ordinary heels and cost no more.

Black, white or tan. For men, women and children
All dealers

Foster Rubber Company
105 Federal Street, Boston, Mass.

Originators and patentees of the Foster Friction Plug which prevents slipping

While the laws of the Latin-American countries offer unusual opportunities for the piracy of trade marks, warnings are also being received from many other countries of the preliminary work which is being done with a view of passing off inferior goods as those of American manufacturers.

This opportunity to steal American trade marks exists because of the neglect of our manufacturers to comply with the registration laws of the countries in which they sell their merchandise. In many cases a manufacturer at first makes only small shipments abroad and he does not care to go to any expense to protect his foreign trade rights until it is clear that his foreign business is on a permanent basis. Even then he often hesitates to pay the necessary registration fees, reasoning that inasmuch as his trade mark has not been infringed in the past, he is safe as to the future. But this reasoning is unsound, and manufacturers who sell abroad should see that their trade marks are protected in accordance with the foreign laws, for otherwise they will probably find that they have lost their foreign trade just when it becomes of considerable value.

The trade mark laws of many of the foreign countries differ from the trade-mark laws with which our manufacturers are most familiar, in this important respect: in the United States property in a trade mark is acquired by use and is confirmed by registration, while, in most other countries this is not the case, for many foreign laws require registration before private ownership of a trade mark is recognized. When an American manufacturer neglects to register his trade mark in the foreign countries in which he is selling his goods, he is spending money to establish a business which may not only be taken from him by the first thief who comes along, but may be retained by the thief as the manufacturer in that case is without redress.

Another German Monopoly Broken

AMONG the products formerly imported from Germany is bronze powder. The United States industries use practically 6,000,000 pounds of this annually, and 35 per cent of our total consumption was formerly imported from Germany. For many years German manufacturers have been practically controlling the bronze powder trade in this country, due to the fact that they have been offering prices which were less than those of the American producers. Bronze powder is manufactured in over 200 grades, differing in color and texture.

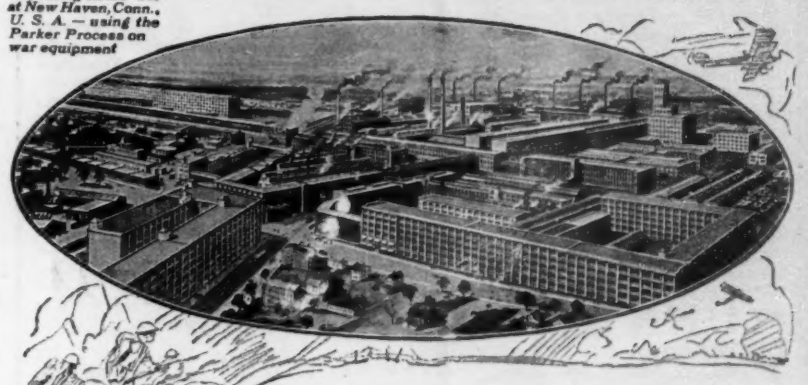
Germany had a steady market in Europe for all the higher grades of bronze powder that they manufactured. They did not, however, have a European demand for the lower grades and as a result exported large quantities of the lower grades to America. German firms made such a large profit on their finer grades that they could offer to sell the lower grades very cheaply. As a result of this condition our present enemies placed their products on our market at a price, which although it included import duty, was lower than the price at which corresponding grades could be produced by American manufacturers.

The war, however, stopped our imports of bronze powder. The American manufacturers, seeing their opportunity to get this trade, instantly increased their manufacturing facilities to supply the demand. The opportunity to supply the trade without foreign competition gave our manufacturers a chance to study the requirements of the users of bronze powder and to change their methods of production so as to give a product that would suit these needs.

The success of their endeavors is attested to by a large user of bronze powder who has for many years bought German made powder in preference to American brands and who now says: "The American product has almost reached the standard of the German powder and we believe that at the end of the war the quality and price of, the domestic product will be so attractive as to make any foreign competition impossible."

After the Hun With RUST PROOF Weapons!

Plant of Winchester Repeating Arms Co. at New Haven, Conn., U. S. A. — using the Parker Process on war equipment



"OVER the Top" with Rust Proof weapons go the soldiers of Uncle Sam!

Passed by rigid government tests, the Parker Process is now being used on army rifles, bayonets, machine gun parts, hand grenades, bolo knives, trench knives, bicycles, motorcycles, mine cases, buoys, aeroplane parts, food containers, bridle bits, stirrups, truck parts and other equipment of war.

Government Endorsement Bears Out the Experience of American Industry

The endorsement of the Parker Process for use on war equipment by the U. S. and British governments must prove to the most skeptical that the Parker Process does prevent rust.

This official action bears out the experience of the leading American manufacturing concerns who have been protecting their products from rust by the Parker Process for several years.

A Book on Rust Proofing for Industrial Executives

No matter what you manufacture—if you use steel or iron you will find it interesting to read the recently published Parker Process Book. This explains how the Parker Process is rapidly reducing the great toll rust takes annually from our steel supply—how it is now being used on metal articles from automobiles to fountain pens—from building hardware to typewriters—and how easily you can apply it to your own product in your own plant without interfering in any way with your present manufacturing plans. To be sure of a copy from the first edition dictate a note at once.

Parker Rust Proof Company
of America
Detroit Michigan U. S. A.

PARKER PROCESS

PARKER PROCESS
RUST PROOFS IRON AND STEEL

LEGAL NOTICES.

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to *Patents, Trade Marks, Foreign Patents,* etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & CO.

SOLICITORS OF PATENTS

233 Broadway, Woolworth Building, New York

And 625 F Street, Washington, D. C.

Annual Subscription Rates for the Scientific American Publications

Subscription one year..... $4.00

Postage prepaid in United States and possessions, Mexico, Cuba and Panama.

Subscriptions for Foreign Countries, one year, postage prepaid..... $5.50

Subscriptions for Canada, postage prepaid.... 4.75

The Scientific American Publications

Scientific American (established 1845)..... $4.00

Scientific American Supplement (established 1876)..... 5.00

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Classified Advertisements

Advertising in this column is $1.00 a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

PATENT FOR SALE

I HAVE INVENTED a new Device for mixing concrete, one hundred per cent more efficient and economical than former types. Patents for sale or royalty basis. Box 116, Newark, Ill.

SITUATION WANTED

A YOUNG MAN of creative temperament would like work with a Chicago inventor. Address W. D. S., Box 773, care of SCIENTIFIC AMERICAN.

THE MIDGET SLIDE RULE

will add, subtract, multiply, divide; solve problems involving even and uneven roots and powers. Also gives the Logarithms of Numbers and the Sines, Cosines, Tangents and Cotangents of all angles. Its operation is very simple; quickly solves any mathematical problem. Durably made of metal. Adapted for shop and office use. Fits the pocket. 5½" in diameter. Price with instructions **$1.00**

Send for free descriptive circulars.

Your money back if you are not satisfied.

GILSON SLIDE RULE CO., Niles, Mich.

Delivered TO you FREE

Your choice of **44 styles, colors** and sizes in the famous line of **"RANGER"** bicycles, shown in full color in the big new Free Catalog. We pay all the freight charges from Chicago to your town.

30 Days Free Trial allowed on the bicycle you select, actual riding test in your own town for a full month. Do not buy until you get our *great new trial offer* and low Factory-Direct-To-Rider terms and prices.

TIRES LAMPS, HORNS, pedals, single wheels and repair parts for all makes of bicycles at half usual prices. No one else can offer such values and such terms.

SEND NO MONEY but write today for the big new Catalog. It's free.

Rider Agents Wanted

MEAD CYCLE COMPANY Dept. T. 175 Chicago

CHALFONTE

Atlantic City, N. J.

The South Jersey Coast is delightful as this season. Chalfonte appeals to cultivated, interesting people seeking rest and recreation. Modern, 10-story, fireproof. Right on the beach and boardwalk. All sports and pastimes. Golf and yacht club privileges.

American Plan *Always Open*

THE LEEDS COMPANY

It is best to make reservation ahead for Chalfonte. Write for illustrated booklet and rates.

NEW BOOKS, ETC.

MILITARY OBSERVATION BALLOONS. By Emil J. Widmer. New York: D. Van Nostrand Company, 1917. 8vo.; 158 pp.; 3 plates, 38 illustrations. Price, $3 net.

This handbook, based on the Balloon Manual of the German Army, thoroughly describes kite, spherical captive, and free balloons, from their manufacture, equipment and inspection to the mode of handling them in the field. The examination and acceptance of the fabric, and its care and repair, are fully treated; the duties of the balloon squad, the car squad and the rope squad are distinctly outlined; and the construction of parts, the operation, and company training and maneuvering are made the subjects of plates and diagrams that convey facts in the most straightforward manner possible. Free balloon equipment, the preparation for ascension and the ascension itself are covered in the final chapter. In view of the importance that air operations have assumed in the warfare of today, this work deals with a vital phase of military operations in a most efficient and successful way.

SELECTED PAPERS ON PHILOSOPHY. By William James. With an Introduction by Prof. C. Bakewell. New York: E. P. Dutton & Co. 12mo.; 290 pp. Price cloth, 60 cents net; leather, $1.25 net.

Those who scorn philosophy as a wordy and impractical study are those who never read William James. The fact that the first essay in this volume introduces long quotations from Robert Louis Stevenson and Walt Whitman is sufficient evidence that it deals with life rather than with intellectual abstractions; it abounds in shrewd appraisals of American character, and reveals faults only to suggest remedies. "The Energies of Man," "Habit," "The Will,"—all these papers connect up the needs of everyday life to certain sources of understanding and strength. This selection from the works of the famous Harvard professor and psychologist has been made with excellent judgment, and is both representative and comprehensive.

TARAS BULBA AND OTHER STORIES. By Nicolai V. Gogol. New York: E. P. Dutton & Co. 12mo.; 327 pp. Price, cloth, 60 cents; leather, $1.25 net.

Gogol, that pioneer in the field of Russian fiction, is worthy of all the praise that has been bestowed upon him; he should find a larger audience here, and now that "Everyman's Library" has taken him up, the power of his pen will doubtless bring the airs and perfumes of his native steppes, the rude vigors and virtues of his Cossack brethren, into revivifying contact with our modern intellectual lassitude. Some of the descriptions in "Taras Bulba" may stand unashamed before those of the "Arabian Nights," and its revels and battles recall Salambô and Flaubert, but with an atmosphere all their own.

BROOKLYN DAILY EAGLE ALMANAC. 1918. Brooklyn, N. Y.: Eagle Building. 8vo.; 600 pp.; with maps. Price, $1.

The Eagle Almanac partakes of the nature of an established institution, and its annual appearance is awaited by a multitude whose partisanship is not unjustified. There are the usual revised lists of hospitals and charitable organizations, societies and associations. Government and politics, business and banking, capital and labor, religion, education, and sport, all are presented in articles and statistics with remarkable accuracy. There is a good summary of the world war in 1917, followed by a chronology of the whole conflict, day by day and month by month. Other articles worthy of remark are those on the Russian revolution, the allied war missions, and Wilson's world peace plan. In its *rôle* of "New York City Red Book" the Almanac has a wealth of material; there are street directories, piers are located, populations are classified, districts and boundaries are given, parks, drives and statues are listed and described, and the various transit systems and routings are explained. In a cover pocket we find two large sheets of maps covering in profuse detail Greater New York and its environs. The above remarks necessarily cite but a very few of the outstanding features of this encyclopedic work; seldom indeed will a consultant be disappointed in the search for any information coming within the wide scope of the volume

TACTICS AND DUTIES FOR TRENCH FIGHTING. By Georges Bertrand, Capitaine, Chasseurs Alpins, de l'Armée de France, and Oscar N. Solbert, Major, Corps of Engineers, U.S.A. New York and London: G. P. Putnam's Sons, 1918. 16mo. 242 pp.; with diagrams. Price, $1.50.

The war is constantly giving birth to new weapons and new methods. At its inception, infantry armament consisted almost entirely of the rifle and bayonet; today each company is supplied with hand-grenades, rifle-grenade guns, and automatic rifles, and specialists in the use of these arms have been developed. Tomorrow may bring about important modifications in practice; but it is the officer most familiar with present methods who will most readily adapt himself to changing conditions. The authors of "Tactics and Duties for Trench Fighting" describe and evaluate the methods of the minute; they delineate the organization of the company for battle formations, develop a position from an open battle, cite sector and trench duties, give the routine of relief, sketch the defense and attack of a position, and make clear special operations such as raids, gas warfare, liquid fire, and mines. The work is highly endorsed by military instructors, and the Secretary of War has approved its publication for the benefit of camp graduates.

What Is A Spy?

Have you ever had that question clearly answered?

Is an enemy alien that gives information a spy?

Is a man who is confessedly a German officer a spy?

Is a woman of German birth who accidently learns something of importance and tells it, a spy?

What is a spy?

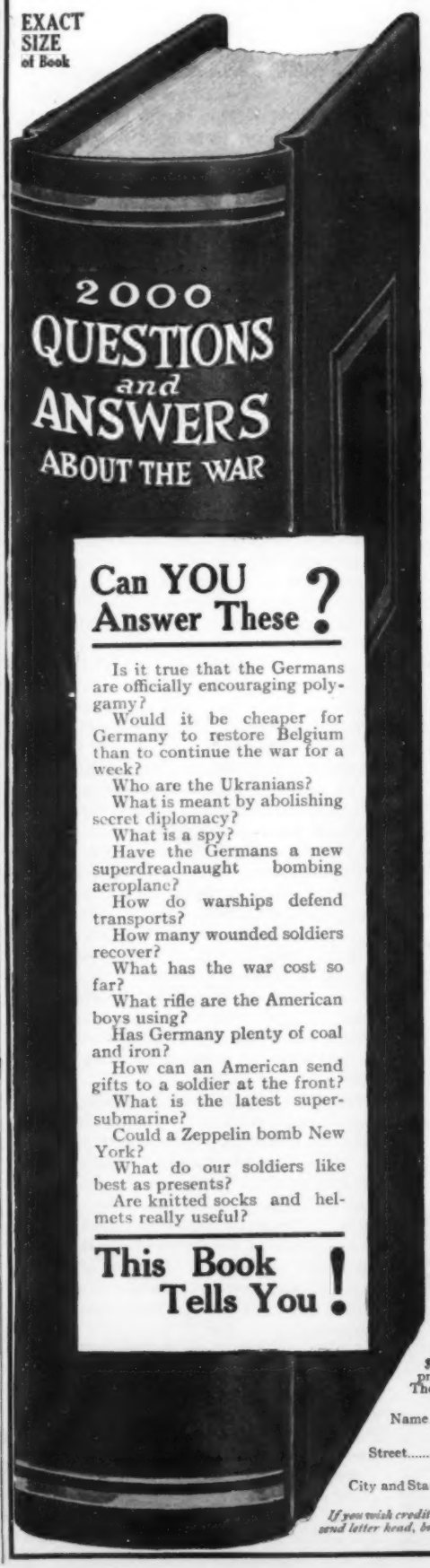
What must a person do to be shot as a spy?

The answer to this and 2,000 other questions of the war—questions that are perplexing us all when we read the many confusing details of this world cataclysm—you will find in the new authoritative

"2,000 Questions and Answers About the War"

In it are answers to every imaginable question about the war. This magic book is more enlightening, more entertaining than any war lecturer you ever listened to. The politics of the war—the history of the war—the racial aspects of the war—the business of fighting the war—the marvelous and unending interest of the new war machinery—tanks—depth bombs—flare lights—Zeppelins—big guns—submarines—pill boxes—aeroplanes—parachutes and a thousand more wonders of the war are described in language you can understand.

EXACT SIZE of Book


2000
QUESTIONS
and
ANSWERS
ABOUT THE WAR
Can YOU Answer These ?
Is it true that the Germans are officially encouraging polygamy?
Would it be cheaper for Germany to restore Belgium than to continue the war for a week?
Who are the Ukranians?
What is meant by abolishing secret diplomacy?
What is a spy?
Have the Germans a new superdreadnaught bombing aeroplane?
How do warships defend transports?
How many wounded soldiers recover?
What has the war cost so far?
What rifle are the American boys using?
Has Germany plenty of coal and iron?
How can an American send gifts to a soldier at the front?
What is the latest super-submarine?
Could a Zeppelin bomb New York?
What do our soldiers like best as presents?
Are knitted socks and helmets really useful?
This Book Tells You !

A Dozen War Books In One!

It is a big book, 9¼" x 6¾", handsomely and durably bound in cloth.

It answers over 2,000 questions about the war, entertainingly and authoritatively, by experts.

It contains 32 pages of new war maps printed in colors.

It has a new up-to-date pronouncing dictionary of foreign names, so easy that everyone who reads may now pronounce correctly town names like Ypres, Amiens, etc.

It has four big pages of American Army and Navy insignias, enabling you to identify by rank every officer you see.

It shows a page of war medals.

It contains a nine-page, down-to-the-minute of going to press, chronology of the Great War.

Its complete contents is skilfully classified and indexed for easy and quick reference.

It is literally a dozen war books in one.

Why You Can Get This War Book Free With Your Subscription

So that you can "see" this great war into which America has thrown her huge strength, so that you can intelligently follow the battles in France, where the destinies of free people are the stakes, two big magazines, the METROPOLITAN and REVIEW OF REVIEWS, have united in a big subscription campaign to put both of these indispensable magazines into 100,000 American homes.

All you need do now to start the great war book and the *METROPOLITAN* and *REVIEW OF REVIEWS* to your home, each, for one year, is to mail the coupon on this page to the METROPOLITAN *with only 10 cents.* (If you are already a subscriber to each magazine your subscription will be extended.) After that you pay $1.00 a month for only 5 months—less than the magazines cost at the newsstands. *The Great War question book is yours free.* We even pay the carriage charges. If you prefer to make only one payment send $4.75 with the coupon. Mail the coupon today, so that we can supply you out of the first edition of the question book. If you postpone action you may have to wait for a second printing. Act today and be among the first.

Send Only 10c. With This Coupon

METROPOLITAN,
432 Fourth Avenue,
New York.

S.A. 5-11

Gentlemen: I enclose 10 cents. Send me, (free and postpaid, your new war book **"2000 Questions and Answers About the War."** At the same time enter my subscription to **METROPOLITAN** and **REVIEW OF REVIEWS** each for 12 months. I agree to send you $1 a month until I have paid $5.10 in all for the magazines. If I prefer to pay cash the total will be $4.75. The big war book is mine free.

Name.....

Street.....

City and State.....

If you wish credit and are not known to our book dept. kindly send letter head, business card or names of two references.

DU PONT AMERICAN INDUSTRIES

DU PONT

CHEMICAL PRODUCTS
for Factory *and* Laboratory

Du Pont chemicals and chemical products are known Nation-wide for their dependability. The first essential in chemical manufacture is to understand the uses to which a chemical is to be put. The next step is to produce the best possible chemical for the purpose. On this concrete formula rests the success of the Du Pont Line.

DU PONT

Mark X before subject that interests you and Mail This Coupon to

Du Pont Chemical Works
Equitable Building
NEW YORK (E. A.) N. Y.

- Acetic Ether
- Amyl Acetate
- Aniline Oil
- Bronzing Liquids
- Collodion
- Dark Creosote
- Dead Oil
- Dimethyaniline
- Dinitrophenol
- Ether, U. S. P.—1900 and Anesthesia
- Ethyl Acetate
- Flotation Oils
- Iso Amyl Acetate C. P.
- Iso Amyl Alcohol C. P.
- Wood and Metal Lacquers
- Leather Renovators
- Leather Substitute Solutions
- Mantle Dips
- Naphthalene
- Nitre Cake
- Nitrobenzol
- Parlodion
- Patent and Split Leather Solutions
- Pegamoid Aluminum Paint
- Pitch
- PONTAR—A Road Making Material
- PONTOKLENE—For Cleaning Autos
- PY-RA-LIN—Enamels for Wood and Metal
- Refined Aceton Oil
- Refined Creosote
- Refined Fusel Oil
- Salicylic Acid
- Shingle Oil
- Waterproof Cement
- Wood Preservatives

Name .....

Address .....

City .....

State .....

Name of your concern

.....

Business .....

We Aim to Serve

our customers intelligently by thoroughly understanding their needs. For this purpose we maintain a staff of experts who are at the disposal of our trade, present or prospective, in solving any problems connected with the use of our materials.

We Maintain Quality

by expert supervision, complete laboratory control over factory operations, perfection in technical skill, the best in raw materials and ample factory facilities.

The amalgamation of Du Pont and Harrison interests enables us to assure maximum satisfaction, both in product and service, to those manufacturers and other users of chemicals whose requirements are dependability, responsibility, and adequate supply.

We Invite Correspondence

from manufacturers, engineers and those requiring chemicals and mixtures for specific purposes. Check the coupon and mail it. We will be glad to send full information.

DU PONT CHEMICAL WORKS
HARRISON WORKS
Owned and operated by
E. I. du Pont de Nemours & Co.

The Du Pont American Industries are:

E. I. Du Pont De Nemours & Co., Wilmington, Del., Explosives
Du Pont Fabrikoid Co., Wilmington, Del., Leather Substitutes
Du Pont Chemical Works. Equitable Bldg., N. Y., Pyroxylin & Coal Tar Chemicals
The Arlington Works; 725 B'way, N. Y., Ivory Py-ra-lin & Cleanable Collars
Harrison Works, Philadelphia, Pa., Paints, Pigments, Acids & Chemicals
Du Pont Dye Works, Wilmington, Del. Dyes and Dye Bases

H

Mark X before subject that interests you and Mail This Coupon to

HARRISON WORKS
35th St. and Gray's Ferry Road
Philadelphia (E. A.) Pa.

ACIDS
- Acetic
- Aqua Fortis
- Dipping
- Electrolyte
- Lactic 22% Dark, 22% and 44% Light
- Lactic, U. S. P.—9th decennial Edition
- Muriatic
- Nitric
- Oil of Vitriol
- Oleum
- Sulphuric

ALUMS
- Crystal Potash, U. S. P.
- Crystal Ammonia, U. S. P.
- Filter (22% Al_2O_3) (For use in any make of Mechanical Filter.)
- Pearl
- Pickle
- Porous
- Sizing—For Paper Makers
- Sulphate of Alumina (In all the commercial grades and strengths.)

PIGMENTS
- White Lead (Dry and in Oil)
- Red Lead (84% Pb_3O_4 also 94% U. S. Government Standard)
- Litharge
- Barium Chloride
- Blanc Fixe
- Hydrate of Alumina
- Flake White
- Lithopone (Beckton White)
- Rubber Makers White, Chemical Dry and Pulp Colors

MISCELLANEOUS CHEMICALS
- Barium Nitrate
- Bichromate of Soda
- Distilled Water
- Nitrate of Soda
- Salt Cake
- Strontium Nitrate
- Strontium Carbonate

Name .....

Address .....

City .....

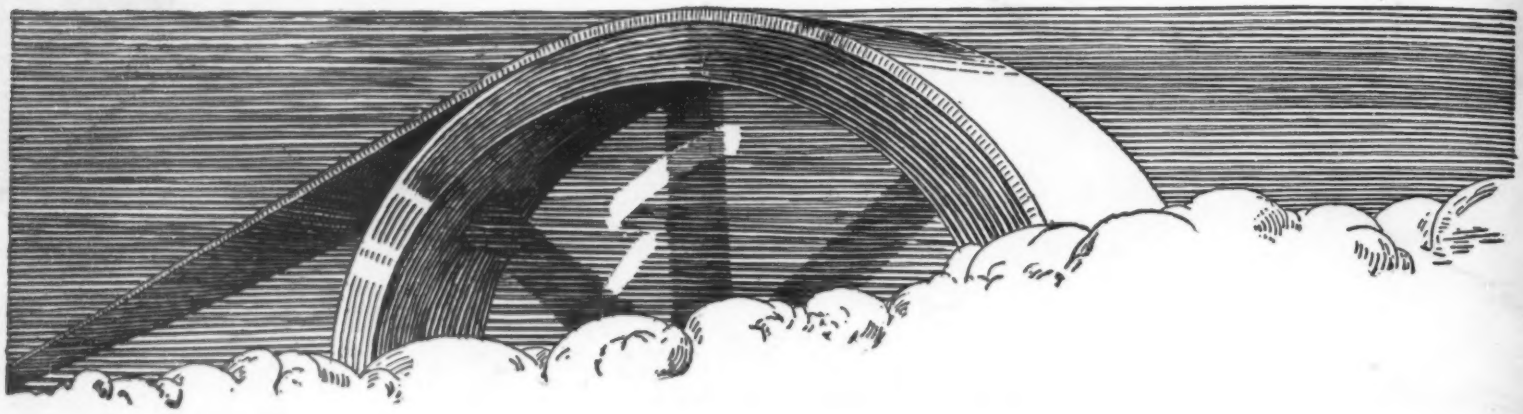
State .....

Name of your concern

.....

Business .....

DU PONT



The Victory Main Drive

Back of every military drive is the industrial "drive" that supplies the munitions, the ships and everything else—except man power—to make battles possible.

And back of the industrial drive is the *main drive* of the power plant that supplies the energy to run the machinery in the mine, the munition works or shipyard.

IRONSIDES RUBBER BELTING

This belt is the real "Victory Main Drive" in many of the plants that are furnishing the means for America and her Allies to "make the world safe for Democracy."

IRONSIDES is a giant in strength, possesses irresistible tractive efficiency and is wonderfully enduring. You can put absolute dependence in this belt to do its duty under "peak load" conditions.

DESERT Conveyor Belt, on a cost-per-ton basis, is an extremely low-priced belt. It holds a commanding place in the metal mining and smelting field.

CROWN Elevator Belt is used in mines, quarries and grain elevators everywhere. Its long life makes Crown a very economical belt.

Belting Specialists are at your command to solve any kind of a belting problem—main drive, conveyor, elevator, etc.

Daniel's EBONITE Pneumatic Tool Hose is helping to build the "bridge of ships" that will carry America's military forces to the battlefront.

Daniel's EBONITE Sheet Packing is holding steam, water and air pipe lines tight in factories where the blowout of a joint cannot be risked because of the delay it would cause.

Daniel's EBONITE Steam Hose is in daily use freeing tubes of soot that would reduce boiler-steaming effectiveness.

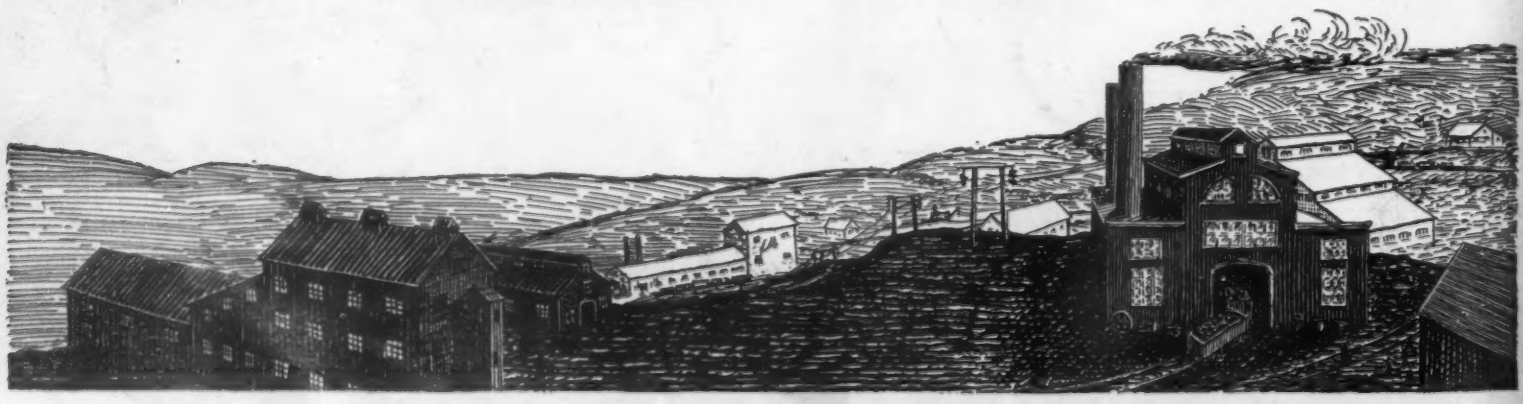
Daniel's P. P. P. Rod Packing is helping to save coal and to insure maximum efficiency from engines and pumps in munition works, steel mills and other plants doing war work. "The Story of Friction Tests"—sent free on request—tells things you should know about packings.

In short, Q. C. R. Co. Mechanical Rubber Goods are helping to win the war. Buyers or users of rubber goods for mechanical purposes should write for a copy of the 180-page illustrated catalogue. Please use your business letterhead.

QUAKER CITY RUBBER COMPANY

MANUFACTURERS OF MECHANICAL RUBBER GOODS

PHILADELPHIA	CHICAGO	PITTSBURGH	NEW YORK
629 Market Street	182 West Lake Street	211 Wood Street	53 Murray Street



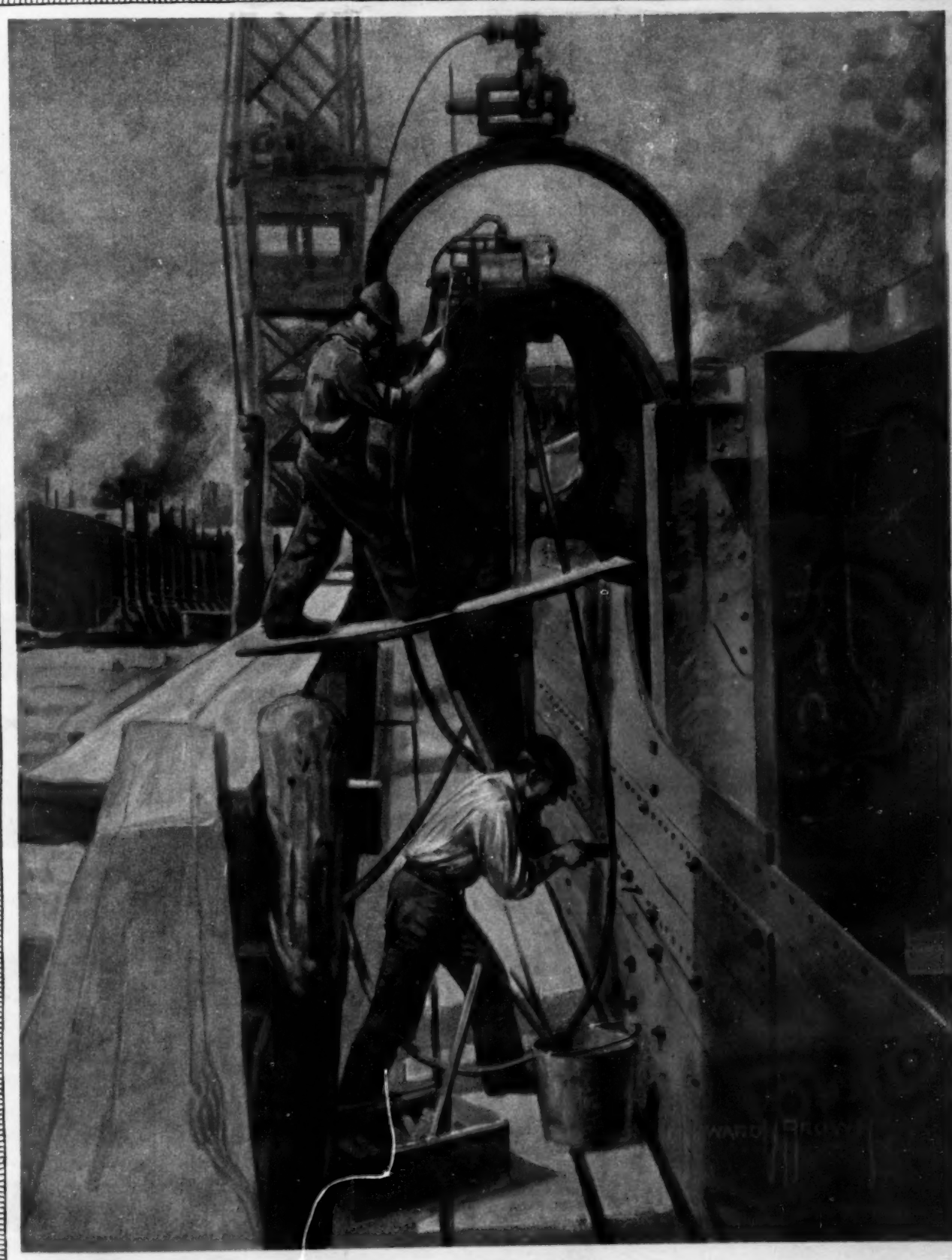
Our subscribers are requested to note the expiration date that appears on the wrapper in which they receive their copies of SCIENTIFIC AMERICAN. If they will send in their renewal orders at least two weeks prior to the date of expiration, it will aid us greatly in rendering them efficient service.

NOTICE TO READER

When you finish reading this magazine, place a one cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed overseas. NO WRAPPING, NO ADDRESS.

A. S. Burleson, Postmaster General.

SCIENTIFIC AMERICAN



HEADING RIVETS WITH A MACHINE WHOSE MASSIVE JAWS ARE CLOSED BY HYDRAULIC PRESSURE [See page 462]

May 18, 1918

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Photograph by L. A. Hiller

Takes out all glare—Legal everywhere

Gives you 500 ft. range

BOTH these cars are equipped with Noviol (yellow-tint) Conaphores. This scientific headlight glass is legal everywhere because it controls the light within the law's requirements, without diffusion and without glare.

The photograph shows the two cars as they meet at a dangerous turn on a dark road.

No confusing glare strikes the eyes of either driver. Both pairs of headlights direct the light where it is most effective—full on the road. Both drivers can see perfectly.

The main shafts of light illuminate every inch of the dangerous going for 500 feet ahead. Ample side-lights shows the treacherous ditch at one side of the road, and the sharp rocky turn at the other. Possibility of an accident is reduced to the absolute minimum.

Signals "Safety" to others

The yellow-tint Noviol Conaphore is a recognized signal of safety on all highways. The instant a driver sees the yellow-tint Noviol lights he knows they will not blind him—and feels perfectly safe. The soft, mellow light is easy on his eyes, and helps him to see past the oncoming car.

Reasons for Conaphore efficiency

Four major advantages make the Conaphore the ideal headlight glass under all driving conditions.

*1. **Kills all glare.*** The Conaphore uses all the light, but patented corrugations control it within legal limits. Height of beam is not more than 42 inches from the road.

*2. **Range 500 feet.*** Corrugations throw a shaft of strong driving light along the road for 500 feet ahead of the car.

The Conaphore has a smooth front surface. Easily cleaned. Does not clog with mud or dust

Manufactured by the World's Largest Makers of Technical Glass

CONAPHORE

No glare—Range 500 ft.—Pierces fog and dust

*3. **Pierces fog and dust.*** Projects a beam that is easy for the eye to follow through fog and dust. This is because yellow-tint Noviol Glass (*patented*) absorbs the blue and violet light waves, thus minimizing diffusion and "back-glare."

*4. **Ample side-light.*** Cylinders fan strong rays out over both roadsides. Light spreads 25 feet at each side of the car 75 feet ahead.

Help make highways safe. Equip your car with Conaphores. They safeguard you, and make for the safety of others. Legal everywhere. Dimming unnecessary. Made in both Noviol and clear glass. Easy to install. Sizes to fit all cars. Order from your dealer; if he has not received his supply, write us.

PRICE LIST

Noviol Glass	Per Pair	Clear Glass	Per Pair
5 to 6½ inches incl.	$2.40	5 to 6½ inches incl.	$1.60
7 to 8½ inches incl.	3.50	7 to 8½ inches incl.	2.50
8½ to 10 inches incl.	4.50	8½ to 10 inches incl.	3.00
10½ to 11½ inches incl.	6.00	10½ to 11½ inches incl.	4.00

Sizes vary by steps of ½ inch above 6½ inch size
Prices 25c more per pair west of Rocky Mountains

CONAPHORE SALES DIVISION
EDWARD A. CASSIDY CO., Mgrs.
275 Madison Avenue New York City

CORNING GLASS WORKS

CORNING GLASS WORKS ALSO MANUFACTURES PYREX TRANSPARENT OVEN DISHES AND PYREX CHEMICAL GLASSWARE

"Yes—Our Truck Fleet Is Clark Equipped—We Find it More Economical!"

In the successful operation of motor trucks—especially fleets, the item of *economical* transportation must be important else the adoption of motor delivery and haulage is not satisfactory to good business men.

And all good business men have learned that mechanical simplicity means efficient and economical results.

Simplicity means *economy*—and motor transportation economy means *Clark Equipped Trucks.*

In the purchase of motor trucks, it pays to specify *Clark Equipment.* It has paid others to so specify. The proof is continual re-orders of *Clark Equipped Trucks.*

CLARK

The name Clark on rear axle and wheel equipment stands for manufacturing ideals—for *accuracy* and *efficiency.*

If in doubt ask for our Reasons Why and Booklet: "Two Heads are Better than One"

CLARK EQUIPMENT COMPANY
BUCHANAN — MICHIGAN

Makers of Clark Rear Axles and Clark Disc Steel Wheels for Motor Trucks

There is a best or better in all things and a reason for it.

The Most Welcome Tire That Ever Came to Market

Some remarkable facts about Brunswicks

The Very Name of Brunswick Certifies an Extraordinary Tire

THE latest tire—the Brunswick—is today the sensation of tiredom. The demand is overwhelming. Single orders have been placed as high as $300,000. All because the very name of Brunswick certifies an extraordinary tire.

It meant a great venture for the House of Brunswick to undertake tire making. Brunswick products in other lines have always held supremacy. And the general idea was that the ruling place was occupied in tires.

But every tire is built to certain standards. Every great tire features certain advantages. Not one tire has heretofore combined all these supremacies. And that is just what we are doing in the Brunswick Tires.

First we secured a staff of experts—masters of this craft. Each came from a famous factory. Each had spent at least 20 years in making high-grade tires. Each pledged himself to the Brunswick idea. That is, to build the best tire possible regardless of its cost. And the Brunswick Tire will prove to you that they've fulfilled that pledge.

While our factory was building, this brilliant staff spent two years in the study of all tires. They analyzed and tested more than 200 types.

They proved out every feature, every formula used in any tire. Not by theory, but by test. Now the Brunswick Tire combines every advantage developed in tire construction.

There is a certain formula, long in use, which makes the best tire tread that's known. In Brunswick Tires we use that formula.

There is a certain type of fabric which, by test, is stronger than all others. It is now in all Brunswick Tires.

There are certain reinforcements—certain extras—which add vastly to tire mileage. We have adopted all.

There is a certain construction which best combats the commonest tire troubles, and we use it.

That is all there is to good tire making. No secrets, no patents prevent any maker from making an ideal tire.

It is a question of cost and care and skill. Also of policy and standards, of prejudice and knowledge. Tires differ as men differ.

We have disregarded cost. We doubt if ever before has a tire been sold on so small a margin.

Yet Brunswick Tires cost you the same as other like-type tires. Our saving is on selling cost, through our nation-wide organization.

Brunswick Tires today hold prestige through the Brunswick name. Every man expects a Brunswick-standard tire.

And every buyer gets it. In a year from now this tire is bound to stand unique among all fabric tires.

See what these standards mean to you by testing a tire or two. They are sold on a 5000-mile adjustment basis. No other tire which we have found gives you so much for the money.

BRUNSWICK TIRES

And Tubes—Three Types of Tread

We Offer to Dealers a Unique Opportunity. Write Us for Our Proposition

The Brunswick-Balke-Collender Co. General Offices: **623-633 S. Wabash Ave., Chicago**

Branches in the Principal Cities of United States and Canada